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Grave Ascending Cholangitis Following Cholangiography Carried out through the Cystic Duct Infected with *E. coli*.

Clinical and Experimental Study.

By

KARL MÄRTENSSON, M. D.

In the literature it is stated that the danger of the operative (= primary) cholangiography introduced by MIRIZZI (1930) is slight or nonexistent. However, these assertions would appear, as far as the author has been able to discover, to be based mainly on clinical observations. Still some experimental work in this field has been done. The toxicity of the injected fluid has been studied by intravenous injections in animals. HULTÉN (1938) mentions that he did not observe any injuries to the bile ducts of rabbits following cholangiography with perabrodil. The clinical findings are hard to judge, since the technique varies, the description of the cases is extremely summary or missing, and the material is often small. A certain technique would seem necessary to eliminate the hazards and the points of view put forward in this connection will be briefly presented.

The technical details discussed in conjunction with the danger of cholangiography are *the shape of the injection cannula, the place of injection, the rate of injection, the fluid used and the quantity injected*. It is stated that the injection if possible should be done through the cystic duct and the tube should be provided with an arresting device (MIRIZZI, BEST and HICKEN and others) or possibly be olive-shaped (MIRIZZI) or have a blunt point fixed with a rubber-covered clamp (HULTÉN and others) in order not to injure the mucous membranes and walls of the deep bile ducts. Most authorities would now appear to be agreed that the injection should be done slowly and without force. Opinions appear to differ concerning the contrast medium and its quantity. As a rule, however, those who first employed larger quantities and later used smaller quantities, found that the complications first observed disappear (ROBINS and HERMANSON-ALTMAN, DESPLAS and others).

The contrast medium formerly most employed, lipiodol (COTTE, MIRIZZI, PRIBRAM etc.), was used by MIRIZZI (1942) in 800 cases without complications from bile ducts, liver or pancreas arising. He injected such small quantities (app. 3 ml), however, that only the principal bile ducts were filled. HICKEN, BEST and HUNT (1937) injected larger quantities but "diluted" the lipiodol with an equal quantity sterile olive oil, whereby its possible irritating action on the mucous membrane of the bile ducts might decrease. Nor did they see any complications.

Of particular interest, it seems to me, is the experience with hippuran (40 % or 48 % orthoiodin hippuric acid). Injected direct into the common bile duct in quantities of 20—25 ml and possibly a further 30 ml after exploration of the common bile duct, it gave in one of the 25 cases of ROBINS' and HERMANSSON'S (1936) an inexplicable high fever. These authors therefore issued warnings for the possibility of the spreading of an acute infection in the bile ducts through cholangiography. With smaller quantities (first 3—5 ml, then possibly 8—10 ml) ALTMAN (ROBINS' clinic 1941) found no added risk by cholangiography with hippuran. BEST and HICKEN (1937) had the same experience with hippuran injected direct in the common bile duct in quantities of 10—20 ml.

It should be added that DESPLAS, MOULONGET and MALGRAS (1938), who employed ténébryl, that is 45 % sodium diiodmetan sulphonate, in quantities of 30—40 ml, later 10—15 ml, observed slight fever or attacks of pain, vomiting, general condition affected and slight icterus in some cases. In addition large series where perabrodil or abrodil was used without complications having been observed have been communicated by HULTÉN, STENSTRÖM and others. LIEBERG (1941), who used perabrodil diluted with half the volume of sterile physiologic sodium chloride solution, observed cases where the cholangiography must be suspected of causing irritation of the pancreas. After my preliminary report on this work and later in his graduation thesis RUDSTRÖM (1944) stated that jodairal forte (Pharmacia, Stockholm — 60 % orthoiodin hippuric acid w. addition of uretane) caused slight pain and discomfort more frequently than those previously seen after cholangiography at HULTÉN'S clinic and that 50 % jodairal did not present any risk. Isolated cases of postoperative cholangitis, among them one fatal case which also had ductogenous liver abscesses, could not be connected with the cholangiography. According to an unpublished communication, ODELBERG (1944), however, observed 2 fatal cases after cholangiography with jodairal forte. In both cases there arose immediately after operation

cholangitis, which led to ductogenous liver abscesses and death. One of these cases had stone in the gall bladder and otherwise altogether unaltered bile ducts — normal cholangiogram — at the operation. ODELBERG asserts that such grave cholangitis does not usually arise in cases like these and says, that the cholangiography with jodairal forte must be suspected having caused the grave postoperative cholangitis in these two cases.

Finally, it may be stated that modern large surveys of complications following operation on the bile ducts do not even raise the question of cholangiography giving rise to post-operative cholangitis (COLP and GINZBURG, JACOBOWICI and PAVEL, HEYD a. o.).

Own Researches.

1. Clinical Part.

To begin with the writer would like to give an account of the 2 cases which drew attention to the possibility that cholangiography could cause grave ascending cholangitis.

Case 1 (J. No. 1294. 44): 40 years old, married woman, who following typhoid fever had had attacks of gallstones. On two occasions, the last 3 years previously, she showed cholecystic symptoms, otherwise always uncomplicated attacks. 9 months before the operation hepatitis was suspected and 3 years before op. she had cancer of uterus, which had been completely cured by radium treatment. Otherwise a healthy person with fresh air habits.

Prior to the operation, as always, there were carried out not only the usual clinical examinations incl. X-ray examination of heart and lungs, electrocardiogram, test of the fluid balance etc. but also a great deal of modern liver function tests. Sedimentation rate was 11 mm per h.; there was a slight decrease in the output of intravenously administered hippuric acid — 72 %, otherwise everything was normal.

At the operation (prof. HELLSTRÖM) stones in gall bladder were found, otherwise nothing pathological. Histologically the gall bladder showed no signs of inflammation but both from the gall bladder content and the cystic duct there was obtained on cultivation a plentiful growth of *E. coli*. In addition there were found in the gall stones scattered subtilis-like rods (cf. MÅRTENSSON, 1941). Cholecystectomy + cholangiography through the cystic duct with app. 10—15 ml jodairal forte were carried out. The latter, executed with olive fitted cannula held in position by rubber-covered clamp, showed entirely normal conditions in the principal bile ducts.

On the very first day after the operation there arose a fever which very rapidly developed a typical cholangitis curve (see fig. 1) Despite the bowels moving there was persistent indisposition and vomiting. On the 4th day tenderness in the liver was observed and on the 8th day leucocytosis and sedimentation rate 122 mm/1 h. and indefinite local tenderness despite soft abdomen. On the 10th day there occurred

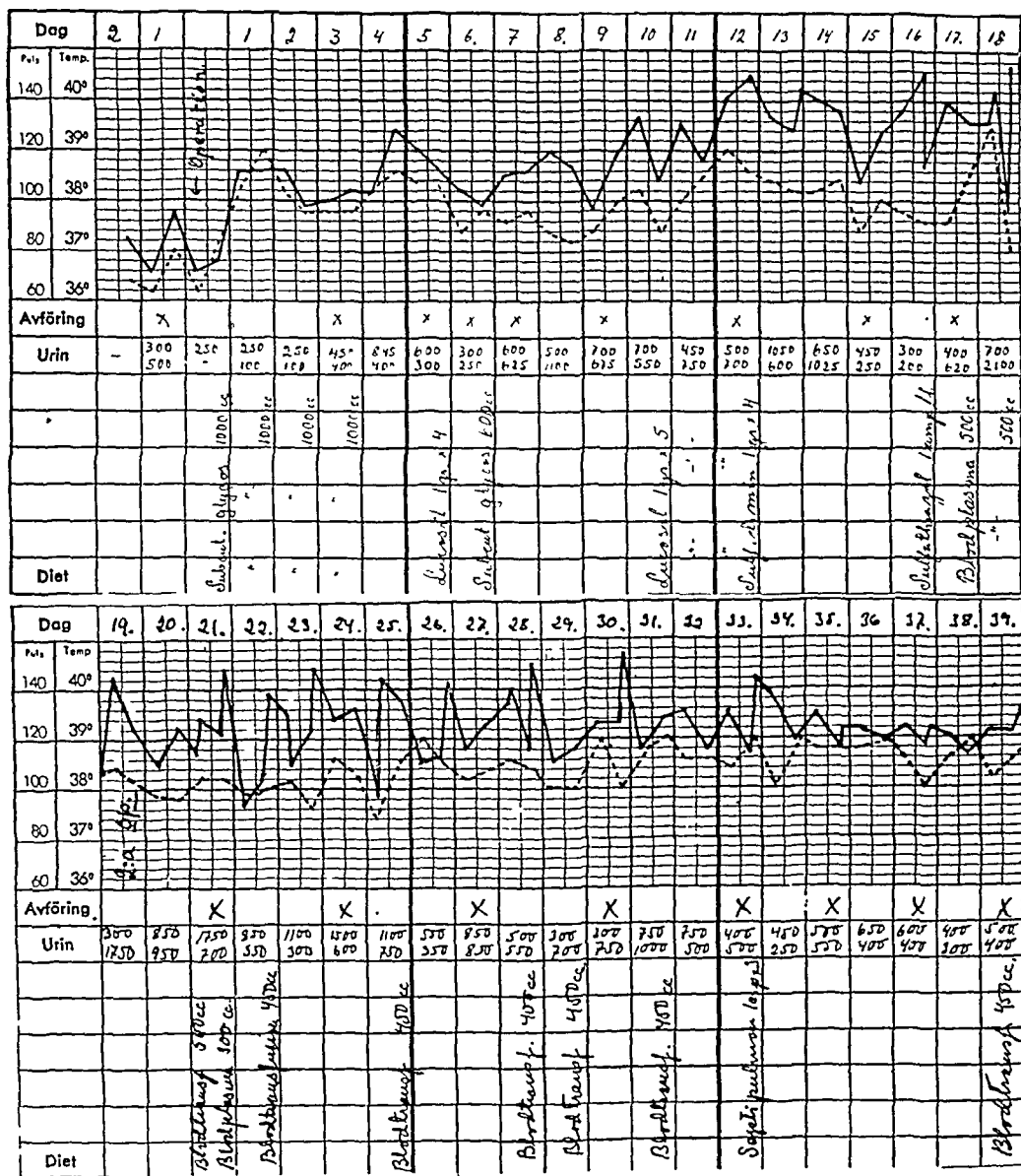


Fig. 1.

— Temperature.
 - - - Pulse.

shiverings followed by the appearance characteristic for cholangitis in the patient but with obvious unaffected general condition between the shiverings. It was noteworthy, however, that no visible icterus existed before transitory scleral icterus began to arise after a little more than 2 weeks. In a test on the 2nd day after the operation, however, Meulengracht was 1:30, otherwise it was normal for the first 2 weeks. Relaparotomy was undertaken 19 days after the operation and there was found a slightly swollen, blue-red liver without palpable abscesses,

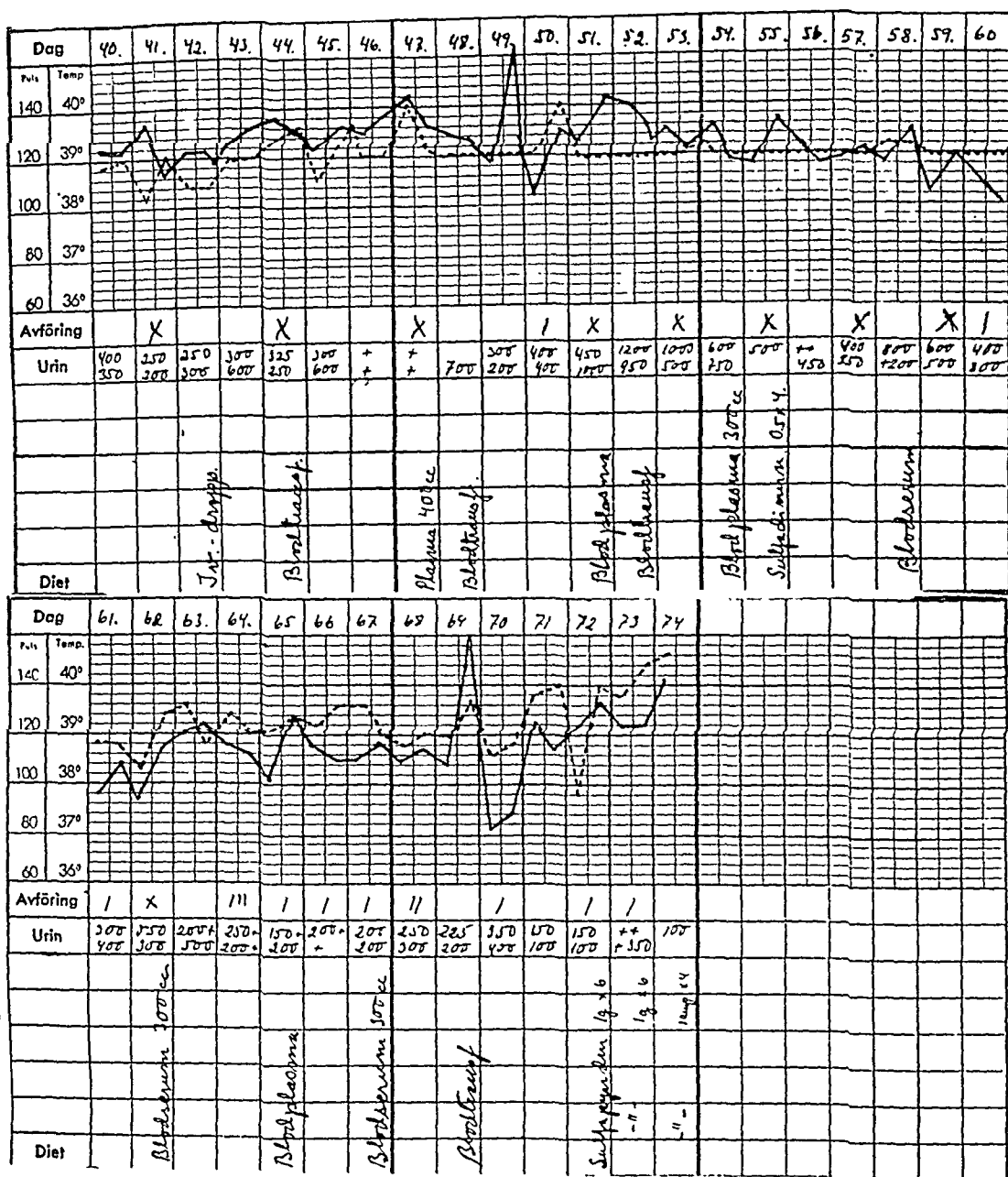


Fig. 1. (Cont.)

walnut-size sterile bile abscess at the old operation field and possibly slight swelling of the ligamentum hepatoduodenale but no sure cholangitis picture. Drainage of the common bile-duct was discussed but only drainage of the bile abscesses was done. Later liver abscesses developed at different spots. Six times these were punctured, and each time there was present *E. coli* in pure culture in the pus, while earlier puncturing of the liver had been sterile. During the whole time of illness the patient received rational cholangitis and liver protection therapy, and the fluid balance was regulated, but in spite of everything she died 2½ months after the first operation.

On autopsy (Prosector WILTON) there was found widespread cholangitis with bile duct thrombes and ductogenous liver abscesses. The bile ducts contained no stones, and no obstacle which might be thought to be primary to the cholangitis could be shown (see fig. 2). From both the common bile-duct contents and the liver abscesses *E. coli* was found in pure culture.

Case 2. (J. No. 920/44), 60 years old man with a period of alcohol abuse 20 years before operation and the last 2 years before operation gall stone attacks, isolated with cholecystitis symptoms and slight icterus. The operation (Prof. HELLSTRÖM) was done on completely "free interval", at which were found stone in the gall bladder but otherwise nothing pathological. Histologically the gall bladder showed slight chronic inflammation and the cystic duct slight sclerosis. Cultivation gave plentiful growth of *E. coli* from bladder content and cystic duct. Only cholecystectomy + cholangiography with jodairal forte was done as in the previous case. The cholangiography showed slightly dilated common bile- and hepatic duct + 3 airbubble-like defects. As no stones appeared with regular washing of the patient's faeces nor at autopsy, the defects would appear also to have been airbubbles. Cholangitis symptoms appeared already in the first 24 hours after the operation and persisted afterwards, and at autopsy nearly 5 months after operation there was seen a diffuse cholangitis with ductogenous liver abscesses of which one had perforated to the sub-phrenic space and had produced a sub-phrenic abscess. Neither in this case could any obstruction be discovered which might be thought to be primary to the cholangitis. Cultivation from the abscesses gave plentiful growth of *E. coli* + α -haemolytic streptococci.

Discussion: To be able to discuss the reason for the post-operative cholangitis in these cases, it seems to me necessary to refer to the researches existing concerning the pathogenesis of cholangitis. As in both the above cases it was a question of ascending cholangitis, only this form of cholangitis will be discussed.

The condition for an ascending cholangitis is considered to be a permanent obstruction to the bile flow, which favours the spread of any bacteria existing in the common bile-duct or duodenum up to the finer branches of the bile tree (LA MANNA, LEOPOLD, CAROLI and MAURY, MANCKE and SIEDA a. o.). The spreading upwards takes place in the principal bile-ducts mainly through the stagnating bile owing to the lymphatic network's poor development and the mucous membrane's faulty resorptive action in these ducts (LEOPOLD). According to the nature and virulence of the infection and the power of resistance (BASSLER, HEYD a. o.) the inflammation in the bile ducts will be outwardly catarrhal, purulent, diphtheric, necrotic. Graver forms, especially phlegmonous, are particularly rare and are only seen after injury to the bile-duct walls (cf. the precautionary measures in cholangiography, p. 1).

The view has also been expressed in recent times that in cases with cholecystitis the infection at operation is found to have spread to the common bile-duct (sphincteritis) and that the post-operative sphincter spasm in certain of these cases, which did not get drainage of the common bile duct at operation, might start the circle of sphincter irritation—bile retention—bacteria increase—aggravated sphincter irritation

etc., which might lead to an ascending cholangitis. In these cases the sphincter spasm is apparent with visible icterus immediately after the operation (JACBOVICI and PAVEL, PRIBRAM). This theory is still far from proved and through the careful work of LA MANNA it seems to have been made clear that *an inflammation in the choledochal-hepatic duct in any case does not encroach on the finer intra-hepatic bile ducts* — give rise to a cholangiolitis — *unless there exists a coarse mechanical anatomic obstruction of the bile flow.*

If the above 2 cases described by the writer are considered, keeping in view the knowledge referred to of cholangitis pathogenesis, then it will be found that case 1 certainly had a rise in serum bilirubin in a test on the 2nd day after operation, which might suggest a more distinct sphincter spasm, but as it was fleeting and no cholecystitis was present at operation it can hardly be compared with the conditions described by JACBOVICI a. o. (see above). Even in case 2 there was a slight dilatation of principal bile-ducts on cholangiography, which in this special case might well suggest a catarrhal chronic choledochitis. In neither of the two cases, however, was there such a coarse mechanical obstruction to the bile flow into the intestine — it was on the contrary normal in both cases — as is considered to constitute the condition for grave ascending cholangitis with ductogenous liver abscesses, as were present in both these cases, to arise. Nor can it reasonably be suspected that a special virulence in the bacteria, a poor resistance in the patient or an operative injury to the common bile-duct wall should have existed. It would therefore appear that some factor hitherto unknown in cholangitis etiology may be suspected as causing the spread of the infection to the finer bile branches. It seems most natural to suspect the cholangiography. This theory is supported by the fact that the *E. coli* infection in the cystic duct has been proved to have rapidly been spread into the whole bile tree that is where the contrast medium had been spread. Even if it might be suspected that *E. coli* were present in the common bile-duct, where they can vegetate without showing symptoms, at the time of operation, this would not alter the rôle of cholangiography in spreading the infection.

As it would be of practical surgical interest to discover *how often and in what cases cholangitis has arisen after cholecystectomy + cholangiography in such a way that the cholangiography may be thought to have contributed to or been the cause of post-operative cholangitis* the clinical material at this clinic for the years 1940, 1941, 1943 and 1944 has been treated with this question in view. All cases of cholecystectomy with or without interfering with the

deep bile ducts and with or without primary cholangiography have been included. The material covers 303 cases with and 188 cases without cholangiography. It is fairly well investigated. Histo-pathological diagnosis of the gall bladder exists in all but 3 cases, cultivation of the gall bladder content in a large number (see tab. 1), the case histories are with few exceptions detailed etc. while laboratory tests, especially after operation, and particulars of the subsequent course are in many cases defective. In respect of cholangitis examination there is in addition the fact that milder cholangitis cases frequently do not or only after long time allow of clinical diagnosis. In addition, for "suspected cholangitis" and "definite cholangitis" there have been required clear symptoms of the said complaints. The investigation, therefore, might only be capable of *showing a minimum for the incidence of post-operative cholangitis after cholecystectomy with or without cholangiography.*

Results: In judging the results the writer has classified the material from 3 different points of view. 1. Occurrence of bacteria with or without inflammation in the bile duct (tab. 1). 2. Occurrence of inflammation in gall bladder or deep bile-ducts or mechanical obstruction to the bile flow (tab. 2). 3. The cholangiographic technique employing in these cases jodairal forte as contrast medium instead of perabrodil (tab. 3).

From tab. 1 it will be seen that definite cholangitis occurred post-operatively in 4 % of the cholangiographed cases, but in only 1.1 % of the cases not cholangiographed. The difference, however, cannot be estimated statistically, since the material is not comparable. If the material is classified as to whether the cases were infected or not (see tab. 1), and if account is then taken only of the occurrence of bacteria in cystic duct, *i. e.* the place where the cannula was inserted for contrast injection in this material, then it will be found that of the 38 cholangiographed and 17 not cholangiographed cases, *where no culture was obtained from cystic duct with content, not a single one had cholangitis after operation.* On the other hand 50 % of the 8 cholangiographed cases where *E. coli* were found in cystic duct and 14.3 % of the 14 cholangiographed cases where other pathogenous bacteria were found in cystic duct had post-operatively definite or highly suspected cholangitis. If these observations are compared with the experience with the cases discussed on pp. 7—8, the suspicion is strengthened that cholangiography through an infected cystic duct gives great risk of post-operative cholangitis, especially where the infection is *E. coli*.

Table 1.

Growth on cultivation	Complications				
	Cholangitis		others	none	
	definite	suspected			
None	GB.	1 —	3 —	55 (17)	33 (60)
	C.	— —	— —	14 (6)	24 (11)
E. coli	GB.	3 (1)	3 (1)	9 (8)	5 (7)
	C.	3 —	1 —	2 —	2 (2)
Other pathogenous...	GB.	1 —	3 (1)	5 (4)	6 (10)
	C.	2 —	— —	4 (3)	8 (10)
No cultivation done		2 (1)	2 —	43 (13)	69 (33)
Total-% complications	cholangio- graphied	4.0 %	4.0 %	43.7 %	48.3 %
	not cholangio- graphied	1.1 %	1.1 %	27.1 %	70.7 %

Figures in brackets indicate not cholangiographed cases.

GB. = gall bladder. C. = cystic duct.

It may, however, be thought that the above results are fortuitous and may be attributed to the fact that so relatively few cases were investigated with a view to occurrence of bacteria in cystic duct. It is therefore necessary that the cases should be considered with regard to the occurrence of factors known as giving a disposition to post-operative cholangitis. From table 2 it will be seen that 8 of the cholangiographed and both the not cholangiographed cases showing definite cholangitis after the operation had common bile-duct complications before or during the operation, which may be supposed to give a disposition to or cause the cholangitis occurring after the operation (cf. Discussion pp. 6—7). From the discussion on pp. 6—7 it will also be seen that the case of post-operative cholangitis that arose after operation on pericholecystitic abscess + cholangiography (see tab. 2) cannot without further evidence be attributed to the cholangiography. As regards the possibility of a post-operative cholangitis after cholecystectomy on acute cholecystitis, there should be added

Table 2.

Clinical and patho-anatomical picture	Number of cases Cholangio- graphy		Complications					
	done	not done	none	Cholangitis		Others		
				suspected	definite			
<i>Cases without com- mon bile-duct com- plications</i>								
Without cholecystitis	61	51	37 (40)	—	1 (—)	23 (11)		
Chronic »	80	82	43 (60)	1 (—)	2 (—)	34 (22)		
Acute »	12	29	3 (22)	1 (—)	1 (—)	7 (7)		
<i>Cases with choledochus complications, pan- creatitis symptoms or liver disease</i>								
Aseptic obstruction removed at opera- tion	27	3	15 (3)	1 (—)	1 (—)	10 (—)		
Others	123	21	49 (12)	9 (2)	7 (2)	58 (5)		

to what is said on pp. 6—7 that, among others, GRAHAM (1928), ÅGERUP (1944) declare that in acute and to a certain extent even in chronic cholecystitis there occurs a probably lymphogenous hepatitis which in cases with acute bacterial cholecystitis may encroach on the finer bile-ducts in the liver and give rise to a cholangitis. MÅRTENSSON (1941) has also shown that in $\frac{4}{5}$ of the cases with gall-bladder stone without symptoms there are changes in the liver which may be interpreted as a slight chronic pericholangitis. Clinical experience like the present study, however, shows that post-operative cholangitis does not usually arise after cholecystectomy alone in cases with stone with or without chronic inflammation in the gall-bladder and without common bile-duct complications (see tab. 2). It is therefore *noteworthy that among the 141 such cases which in this material were cholangiographed definite cholangitis occurred in 3 cases and suspected cholangitis in 1 case, i. e., 2.8 %, while none of the 133 not cholangiographed cases of this kind had post-operative cholangitis.* It is noteworthy also that local complications were present in 41.7 % of these 12 cases where cholangiography was allied to cholecystectomy for pure acute cholecystitis, while local complications did not occur in the 29 cases which were not cholangiographed.

Of the above 4 cases where, without conditions disposing to post-operative cholangitis being present, post-operative cholangitis did arise after cholecystectomy + cholangiography there were found, in the 3 cases where the content of cystic duct was

cultivated, masses of *E. coli*. In the fourth case (J. No. 606. 43) no cultivation was done at the time of operation but later staphylococci were found in bile from the common bile-duct (obtained by drainage). In all four cases cholangitis symptoms came in direct conjunction with the operation. It is of special interest that the staphylococcal infected case, and the three cases where *E. coli* were found in cystic duct but where post-operative cholangitis probably did not occur (see tab. 1) all had primarily common bile-duct drainage, while the 4 cases with *E. coli* in cystic duct where post-operative cholangitis arose or persisted or where death in hepato-renal syndrome occurred post-operatively did not have common bile-duct drainage. In all these coli infected cases the cholangitis took a grave turn and only that which secondarily received common bile-duct drainage gradually recovered. *Common bile-ducts drainage used primarily after cholangiography in cases infected with E. coli would seem therefore to be able to prevent the occurrence of post-operative cholangitis or at least to give such a disease a better prognosis.*

Further study of the 4 cases of post-operative cholangitis, where cholangiography could be suspected as cause, showed that they occurred under the latter half of 1943 and the first half of 1944. It was found that nothing new in operation technique had been introduced during this period, that there was a minimum of operation trauma in all 4 cases but that owing to the difficulty during the war in obtaining perabrodil the contrast medium used instead was jodairal forte. Therefore, as the jodairal may be thought to be the cause of the grave post-operative cholangitis, the material was classified on the basis of contrast medium used, occurrence of infection in the gall-bladder or cystic duct at the time of operation and complications (see tab. 3). It was found then that post-operative cholangitis arose almost only in those cases where cholangiography was carried out with jodairal forte (60 % ortho-iodine-hippur-acid with a small addition of urethane. Americ. hippuran the same in 40 or 48 % solution). As at the same time the percentage of cases with uneventful subsequent course was greater and other complications fewer in the sterile cases during the period of jodairal than during the period of perabrodil (see tab. 3) the suspicion is strengthened that *cholangiography with jodairal forte, particularly if carried out through a cystic duct infected with E. coli, presents great danger of post-operative cholangitis. In those cases where perabrodil was employed post-operative cholangitis only occurred in the cases infected with E. coli* (see tab. 3). It is not possible of course clinically to decide whether cholan-

Table 3.

Incidence of different post-operative complications after use of the different contrast media.

Contrast medium (number of cases)	Cholangitis		Other complications	Uneventful subsequent course
	definite	suspected		
<i>No growth on cultivation.</i>				
Abrodil (62)	—	3.2 %	59.7 %	37.1 %
Jodairal 60 % (73) .	2.7 %	4.1 %	47.9 %	45.3 %
Jodairal 40 % (1) ..	—	—	—	+
<i>Growth of E. coli.</i>				
Abrodil (16)	18.8 %	18.8 %	25.0 %	37.5 %
Jodairal 60 % (10) .	30.0 %	20.0 %	50.0 %	—
Jodairal 40 % (1) ..			Death of hepatorenal syn- drome after 5 days.	
<i>Other pathogenous bacteria.</i>				
Abrodil (6)	—	16.7 %	33.3 %	50.0 %
Jodairal 60 % (18) .	11.1 %	11.1 %	33.3 %	44.4 %
Jodairal 40 % (0) ..	—	—	—	—
<i>No cultivation.</i>				
Abrodil (77)	—	1.3 %	36.4 %	62.3 %
Jodairal 60 % (41) .	7.1 %	4.9 %	36.6 %	51.2 %
Jodairal 40 % (2) ..	—	—	—	++

giography with jodairal forte presents risks for cholangitis. The author has therefore made an experimental study of this question.

2. Experimental Part.

Presentation of the problem: Can cholangiography carried out in the same way as on living persons but with jodairal forte or perabrodil infected with *E. coli*, produce cholangitis in animals with healthy liver—bile-ducts—pancreas—duodenum-systems? If that is the case what is the determining factor — the washing up of the infection into the finer bile-ducts, the injury to the bile-ducts by an injection fluid or a combination of these?

Can anything be done to avoid the injuries or to prevent them assuming a serious character?

a. Animal Experiments.

Material and technique: The size of the material is given in tab. 4—6. On 4 rabbits gallstone had previously been produced by the irritation-free inoculation of "typical Bacilli" in the gall-bladder, described by the author 1941. At the operation the gall-bladder in these cases was macroscopically unchanged as also the liver and the deep bile-ducts, but small concretions were found in

the gall-bladder. Otherwise all the animals were healthy with the exception of one which had scattered coccidious cysts in the liver (rabbit 30). Purposely one experimental animal with recognized strong ability to throw off poison in the liver (dog) and one with poor capacity for such (rabbit) were used.

The technique, which for long offered great difficulties, was as follows: The dogs are pre-administered with morphine subcutaneously, first 5 cg and after intervals of $1\frac{1}{2}$ h. supplementary doses of 3 cg (sometimes more) until the animal without other anaesthesia allows the laying bare of v. saphena magna, where a sterile heparinised cannula is inserted aseptically for intravenous narcosis. Rabbits are not administered any medicine but are put asleep like the dogs by intravenous narcosis with narkotal, which is given in such fractions that the dog is kept just under the state of extinguished reflexes during the whole operation on the abdomen while the rabbit only supports this during the actual cholangiography. The operation is done strictly aseptic with the animal in gall-position, centre line incision in the epigastrium, cystectomy, sample of bile for cultivation (in all the experimental animals proved sterile), introduction of a specially designed metal cannula, which slides very easily in the ducts and has blunted, flexible end, in through the opening of the cystic duct and up into one hepatic duct, firm clipping of the cannula on the cystic duct with padded clamps, slow pouring in of the fluid without the slightest pressure — no dilatation of the bile-duct occurred —, X-ray photography with portable apparatus (exposure for rabbit: 50 Kv., app. 20 Ma + minimum time; for dog individual) and suture of the cystic duct. For the dogs a fine drainage tube is laid against the foramen Winslowi for a couple of days. For the rabbits only suture of the abdomen walls. The whole operation should not for rabbits be allowed to take more than 8—10 min., for dogs a little longer and the operator should be able throughout the time to hold the cannula well fixed and when injecting to observe the position of the point. Sufficient assistance therefore is indispensable.

The emulsion of *E. coli* used for the experiments with infected contrast medium was prepared from a 24 hours old plate culture from a cholangitis case from which a normal loop was taken and homogeneously blended in 10 ml sterile physiologic sodium chloride solution.

Controls: By injecting only one hepatic duct it was possible in one and the same experimental animal *by examining the not injected bile-ducts and liver lobes to control* what changes the operation as such gives in each animal and any post mortal changes in the cases when animals died of changes produced by cholangiography.

As a test of the actual injection of a certain amount of fluid, experiments with injections of sterile physiological sodium chloride solution have been made with the most sensitive experimental animal (rabbit). Not until the technique had been refined and standardised so that 5 of these rabbits in succession definitely survived were

the actual cholangiographic experiments begun. *These 5 rabbits, which were injected with sterile physiological sodium chloride solution in quantities varying from 1.2 to 2.0 ml showed, when they were killed after 11 days, sterile common bile-duct, macroscopic and microscopic no changes in the not injected bile ducts and liver lobes and possibly slight oedema in the walls of the coarser injected bile-ducts, but otherwise no changes* (see fig. 6). In a rabbit which just before this series was injected with 2.0 ml sterile physiological common salt solution and killed after 2 days there were found in patches in the injected hepatic duct very light epithelium injury and swelling of the walls, but otherwise no changes.

Results: Table 4 shows that cholangiography with *E. coli infected jodairal forte* in both dogs and rabbits regularly gives grave ulcerative-necrotic ascending cholangitis which if common bile drainage is not done at the time of operation regularly develops into a picture of cholangiectatic or ductogenous liver abscesses (see fig. 3—5, 7—9, 11) possibly perforation of the liver abscesses into the sub-phrenic space (see fig. 3) or sub-phrenic serositis, pleuritis and broncho pneumonia on the side of the injected liver lobe. In all the animals there developed a grave influence on the general condition, with loss of weight etc. and 3 rabbits succumbed in 3 days. If these observations are put against those in the not injected lobes and bile-ducts, where no or only slight secondary changes were noted (see tab. 4 and fig. 10 a, 12) and with trial testes after injection of sterile physiological sodium chloride solution (see above), then the conclusion must be that *cholangiography with jodairal forte infected with E. coli in both dogs and rabbits produces grave coli-cholangitis which, if common bile-duct drainage is not done, ascends and gives ductogenous liver abscesses etc.* As these in respect of patho-anatomical picture are entirely like those which the author under similar conditions observed on human beings even these last must with the greatest probability be considered as caused by the cholangiography with *jodairal forte* carried out through *E. coli infected cystic duct*.

The question was now: Is the grave post-cholangiographic cholangitis caused by the upwards propulsion of the infection or by injurious effects of the contrast medium? The results of *injection of the same quantity of E. coli*, which in the preceding experimental series was diluted with sterile physiological sodium chloride solution to a total amount of fluid approximating to that in the cholangiography experiments, were as follows: In both dogs and rabbits the animals after about 12 hours (rabbit)—24 hours (dog) became ill, tender in the abdomen and died within

1—2 days. In all of them there was found a purulent coli-cholangitis with diffuse interstitial hepatitis (see fig. 25 a. tab. 4) + possibly lymphogenous pancreatitis, changes which, for the same reason as in the preceding series of experiments, with great probability were caused by the upwards propulsion of *E. coli*. As the changes arising are so uniform it would seem that the relative fewness of the animals cannot upset this conclusion. The propulsion of *E. coli* infection in the bile tree can thus give a grave ascending coli-cholangitis, but the course in this case is more malignant and the cholangitis arising more purely exudative inflammation with not so much in the bile ducts and their close surroundings localized processes in the liver as after cholangiography with *E. coli* infected jodairal forte (cp. 25 and figs. 7—9, 11, 14). The pushing up of the *E. coli* infection can thus be assumed to contribute to, but not alone to cause, the grave post-cholangiographic cholangitis following cholangiography with *E. coli* infected jodairal forte.

What then are the changes produced by cholangiography with sterile jodairal forte? Consideration of this was rendered difficult because the cases were so easily infected secondarily probably from the intestine, whereby changes of the same character as after cholangiography with primary coli-infected jodairal forte arose in the injected hepatic duct and the associated liver lobe (see tab. 5 and fig. 13—15), though somewhat more tardy. These experiments have been included because they are thought to indicate that cholangiography with jodairal forte can give grave post-cholangiographic coli-cholangitis even if *E. coli* are not present in the bile-ducts but in the duodenum at the time of the operation, or if these bacteria through post-operative intestinal paresis invade the duodenum.

By decreasing the total amount of injected fluid there was later successfully obtained the material of not secondarily infected cases cholangiographed with sterile jodairal forte that is reported in table 5. From this it appears that cholangiography with sterile jodairal forte even in relatively small quantities and with precautionary technique gives already after a few minutes microscopically visible epithelium injury (rupture of outer walls of the cells, evacuation of cytoplasm) + sub-epithelial and intramural oedema. These changes are rapidly followed by necrotic ulcerative mucous membrane processes which are succeeded by a (inflammatory?) reaction in the wall with round cell infiltration mainly of eosinophiles and give persisting ulcerative necrosis of the mucous membrane (see fig. 19), strong wall sclerosis in the whole bile tree (see fig. 18) and eventually microscopic liver necrosis (see

fig. 20). In the lumen of the bile ducts plentiful detritus is to be seen (see fig. 19) and possibly bile thrombi. As injection of the same quantity of sterile physiological sodium chloride solution did not cause any changes whatever (see p. 11), the injuries can only be accounted for by the jodairal forte. These changes in fact very much resemble those observed in the cases after cholangiography with coli-infected jodairal forte (cp. fig. 17 and 19) which means that *injurious effect due to the contrast medium probably plays a large part in the occurrence of the grave post-cholangiographic cholangitis following cholangiographic with jodairal forte in coli infected cases.*

The question will then be: Can the injurious effect of jodairal forte be eliminated by diluting the fluid? To determine this the author has made experiments with 40 % jodairal (= the hippuran of the Americans), which would seem to be the lowest concentration to which jodairal can be brought down without its contrast effect being too weak for clinical use. For the same reasons as in the preceding series of experiments the results of the experiments with *cholangiography with sterile 40 % jodairal* (see tab. 5) may be said to show that *changes arise similar in principle to those after 60 % jodairal, though the necrotic processes are little evident or are missing, and the changes only exceptionally (1 case in 7) encroach on the finer intra-hepatic bile-ducts and persist.* In these experiments there was good opportunity to note that the first changes in the epithelium consist in swelling of epithelium's outermost parts and appearance of a great number of fluid filled (fat colouring etc. negative) cavities beneath a stretched but unbroken outer membrane as if the cells were boiling (see fig. 21). At other spots it can be seen that the outer membrane is ruptured and the cell-content thrown out in a cascade from the cell (see fig. 22). These changes, which certainly are less pronounced than the initial ones after jodairal forte, but still very similar to those, seem to me to indicate the result of traction. The most likely explanation of this phenomenon is that *the injurious effect of the jodairal initially is an osmotic effect.* The observations made by LJUNGGREN (1932) in experimental retrograde pyelography with umbrenal seem to support this opinion.

The results of *cholangiography with E. coli infected 40 % jodairal* make it probable that in such cases cholangitis always arises and usually is violent and ascending and as anticipated, patho-anatomically constitutes a mixed type of the cholangitis that is seen after *E. coli-infected jodairal forte* and after only injecting *E. coli emulsion* (see tab. 5 and fig. 24). By diluting the jodairal



Fig. 2. Macro-photo of grave ascending cholangitis in human being, probably caused by cholangiography with jodairal forte through coli-infected d. cysticus.

a. ductogenous liver abscesses. b. scarred d. hepaticus. c. d. choledochus. d. duodenum.



Fig. 3. Grave coli-cholangitis with ductogenous liver abscesses in dog 1 month after cholangiography with E. coli-infected jodairal forte.

a. ductogenous liver abscess with perforation to sub-phrenic space. b. part bent forward of injected liver lobe showing strongly wall-thickened ampule-like enlarged intra-hepatic bile-ducts. c. strongly sclerotic injected d. hepaticus. d. unchanged not injected d. hepaticus with corresponding unchanged liver lobe (f.). e. d. choledochus, unchanged.



Fig. 4. The unchanged entrance part of common bile-duct in duodenum of the same dog as in Fig. 3 showing that the inflammation had not spread from the intestine and that no obstruction would be present to outflow of the bile.



a

b

Fig. 5. Injected d. hepaticus of same dog as in Fig. 3 (near common bile-duct) showing the chronic inflamed wall and in the lumen purulent clots + exfoliated epithelium.

a. large light fluid-filled cells which at b have ruptured and discharged their cytoplasm.

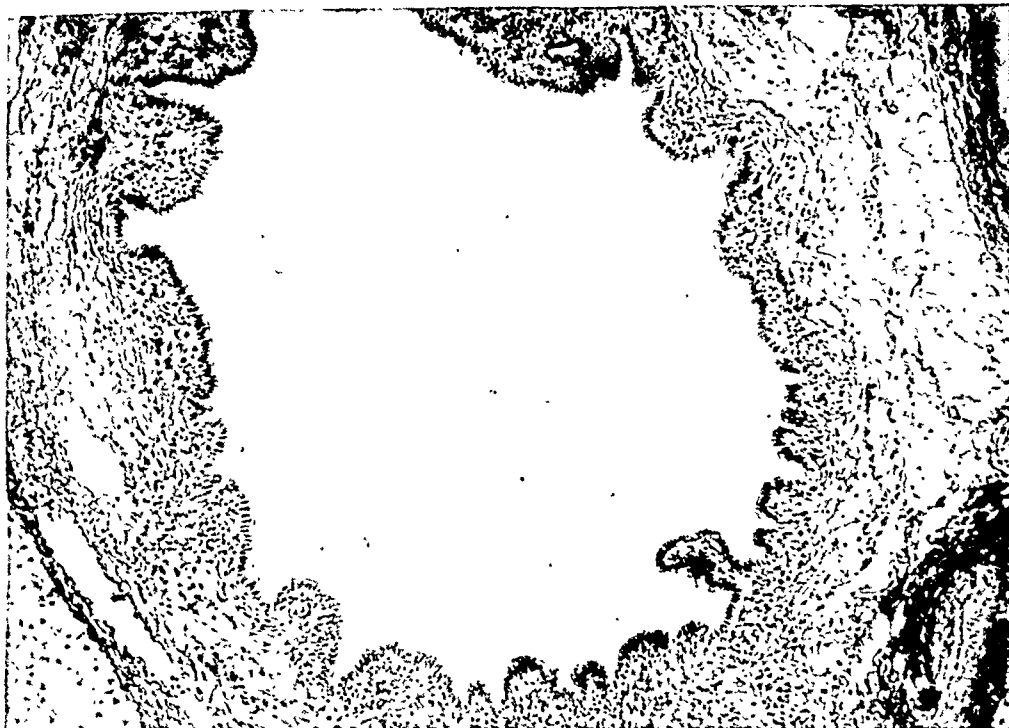


Fig. 6. *D. hepaticus* of rabbit injected 11 days previously with sterile physiological sodium chloride solution in the same quantity as for cholangiography. Mucous membrane and walls entirely unchanged except possibly for a slight sub-serous oedema.



Fig. 7. Cavern-like enlarged intrahepatic bile-duct with granulation-tissue-like sclerosis in the wall and pus in the lumen but mucous membrane fully apparent in spots (same case as Fig. 3).

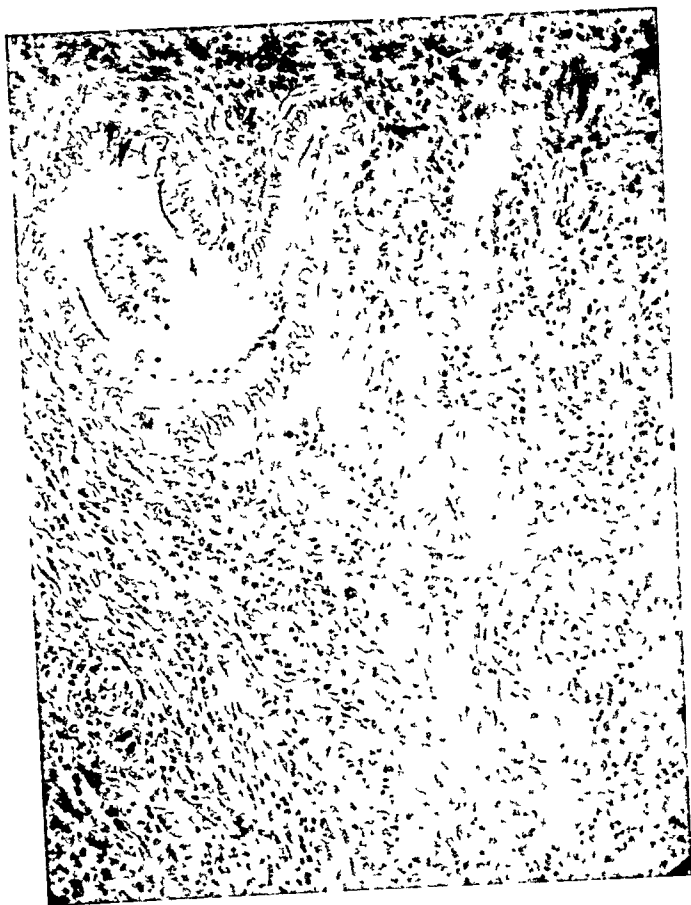


Fig. 8. Enlarged deformed intrahepatic small bile-duct with diapedesis of leucocytes and pus in the lumen = cholangitis (same case as Fig. 3).

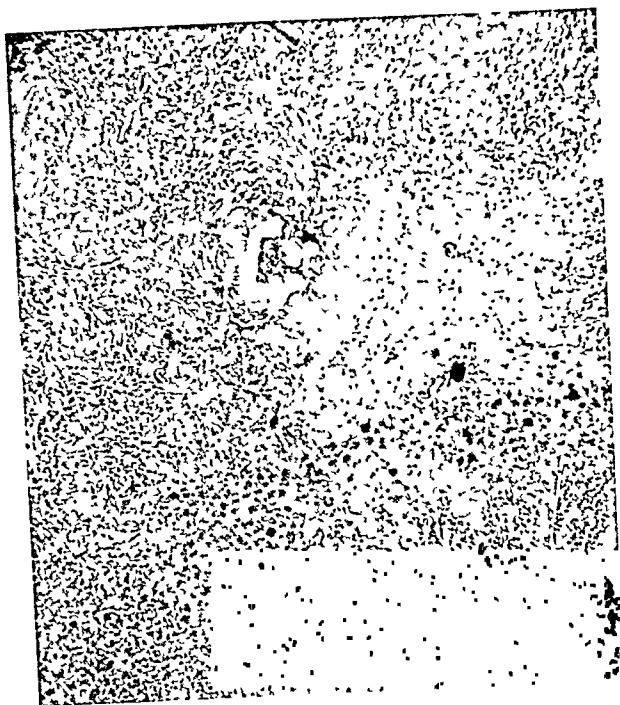


Fig. 9. Small bile-duct with wall of one side entirely destroyed so that lumen opens into purulent liver necrosis (same case as Fig. 3).

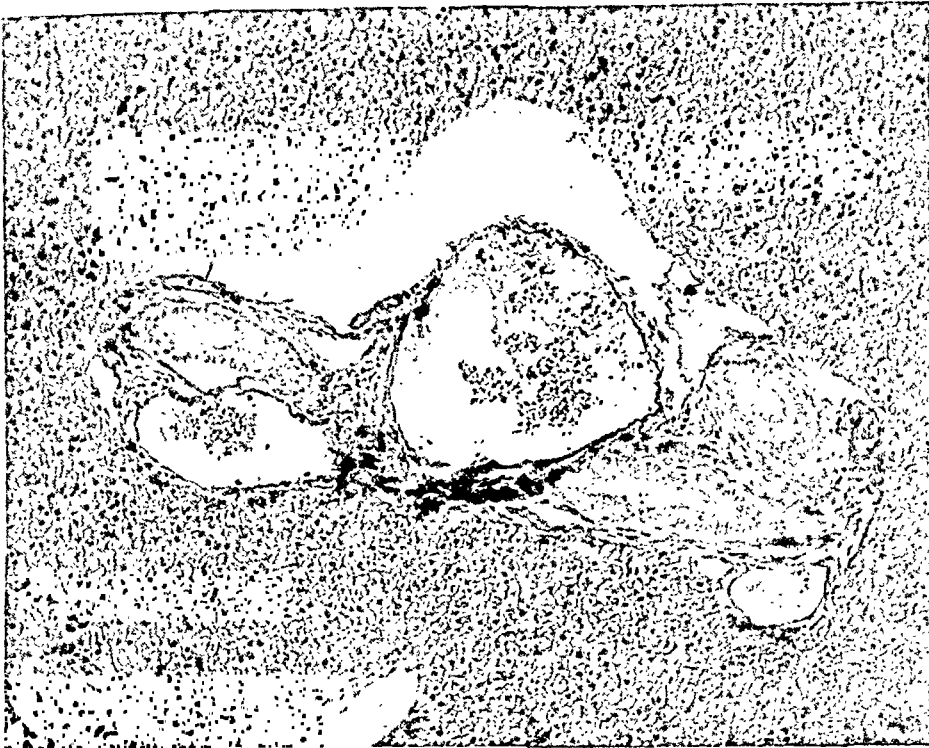


Fig. 10. The not injected liver lobe of same dog as in Fig. 3, unchanged even microscopically.

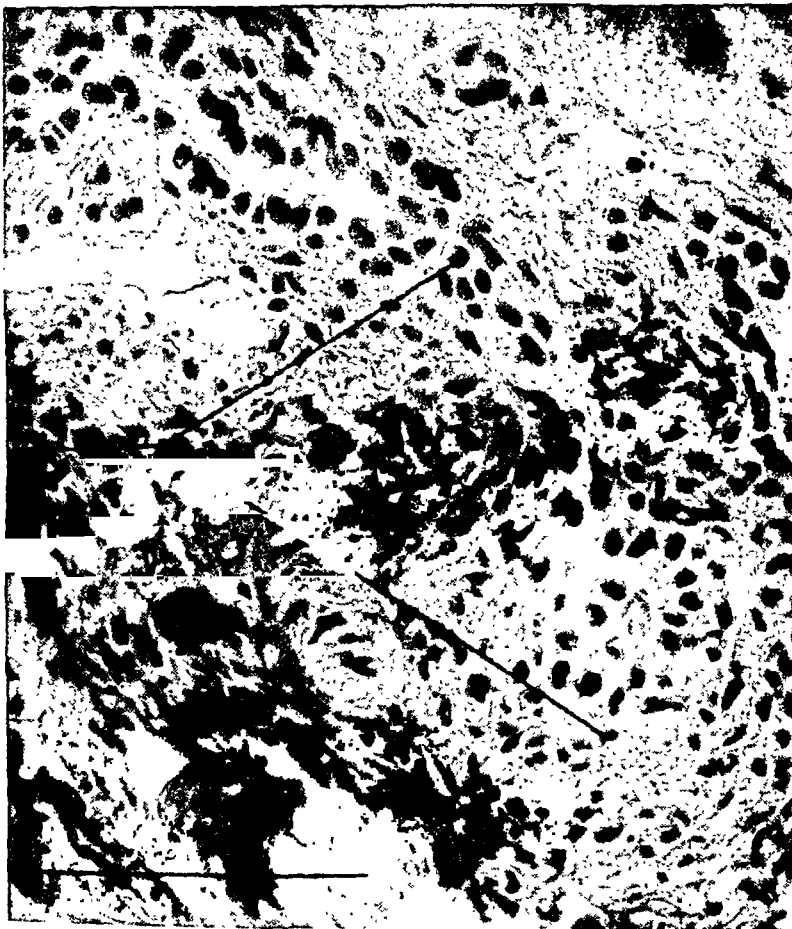


Fig. 11. Rabbit cholangio-graphied with coli-infected jodairal forte.

a. large bile-duct without mucous membrane and with necrotic tissue projecting into the lumen.
b. polynucleous round cells in very small bile-ducts (acute grave cholangitis).



Fig. 12 Part of not injected unchanged liver lobe of same case as Fig. 11.

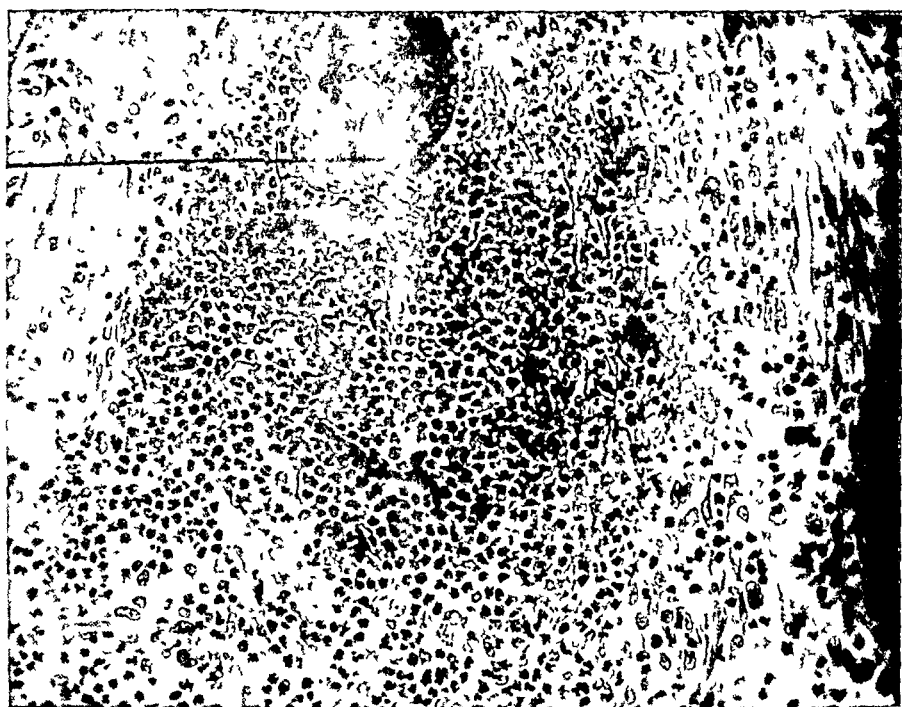


Fig. 13. Liver changes (dog 4) arising after cholangiography with jodairal forte + secondary infection by *E. coli*.

a. rupture of necrotic bile-duct wall with ductogenous liver-abscess.



Fig. 14. Interstitial cholangiolitic purulent-sclerotic inflammation with foreign bodies (a) and giant cells of foreign body type (b) from injected liver lobe in dog 4.

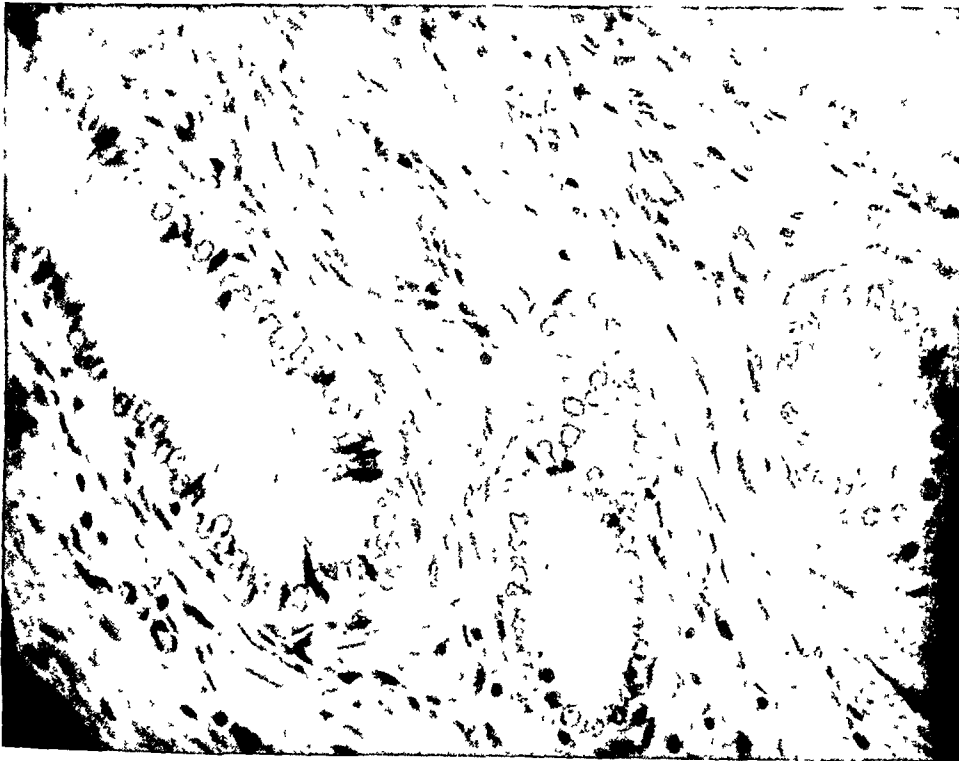


Fig. 15. Not injected, unchanged liver lobe of dog 4.

a
b



Fig. 16. Injected d. hepaticus 20 h. after cholangiography with coli-infected jodairal forte. Wall oedema, hydropic epithelium cells (a) and subepithelial oedema (b.) Hardly visible inflammatory exudate.

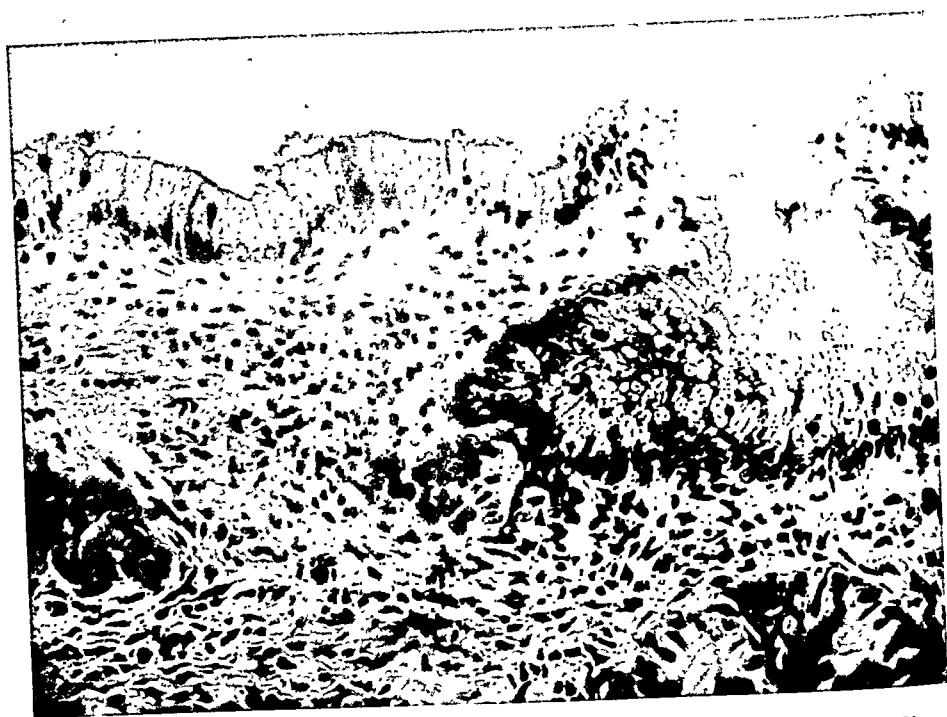


Fig. 17. Late changes in injected d. hepaticus after cholangiography with coli-infected jodairal forte (dog). Note! Similarity in epithelium injury to Fig. 19 after sterile jodairal forte.



Fig. 18. Late changes in rabbit after cholangiography with sterile jodairal forte.

a. Section surface of the unchanged not injected liver lobe. b. section surface of injected liver lobe showing the sclerotically enlarged wall-thickened bile-ducts and the atrophy of the liver. c. sclerotic injected d. hepaticus. d. unaffected d. choledochus.



Fig. 19. Late changes in d. hepaticus of dog injected with sterile jodairal forte.

a. partly cristalline debris and at *t* small thrombi. b. karyorrhexis. c. water vacuole. d. sub-epithelial oedema beneath strongly swollen hydropic cells with blurred nucleus-cytoplasm boundary.

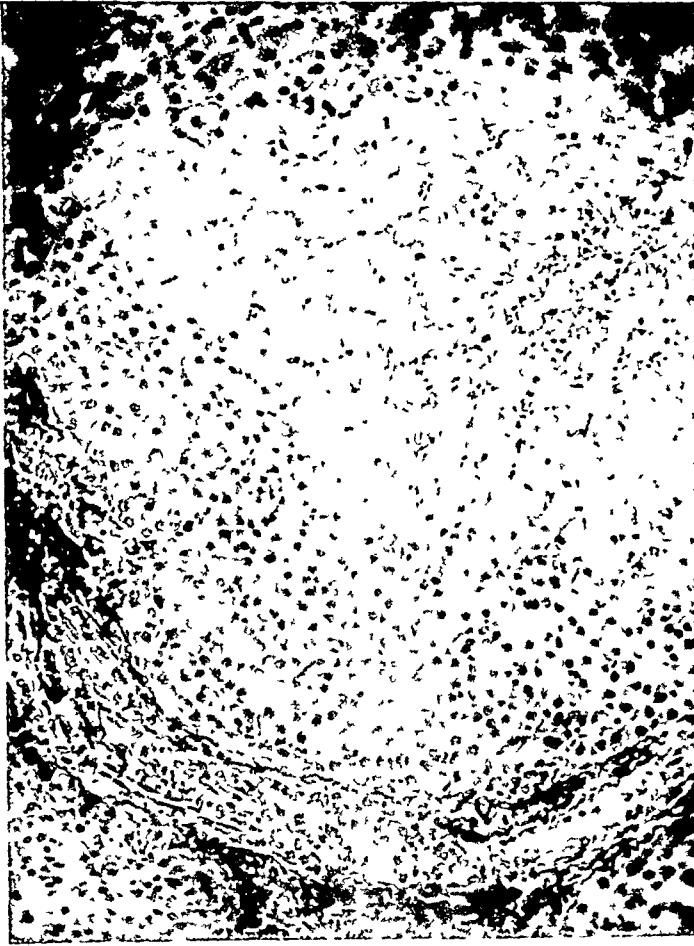


Fig. 20. Central acinous liver necrosis + inter acinous bile-duct with markedly destroyed partially dissolved epithelium membrane and slight wall sclerosis (sterile jodairal forte).

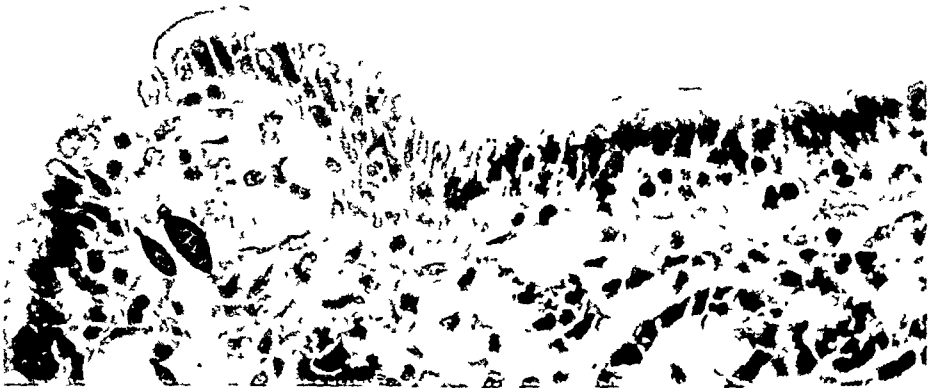


Fig. 21. Part of mucous membrane in d hepatic branch 20 min. after cholangiography with sterile 40 % jodairal. There can be seen the outer membrane of the epithelium as if lifted up with a light zone under (a) and at one place soapbubble-like swelling of the outermost parts of the epithelium (b).

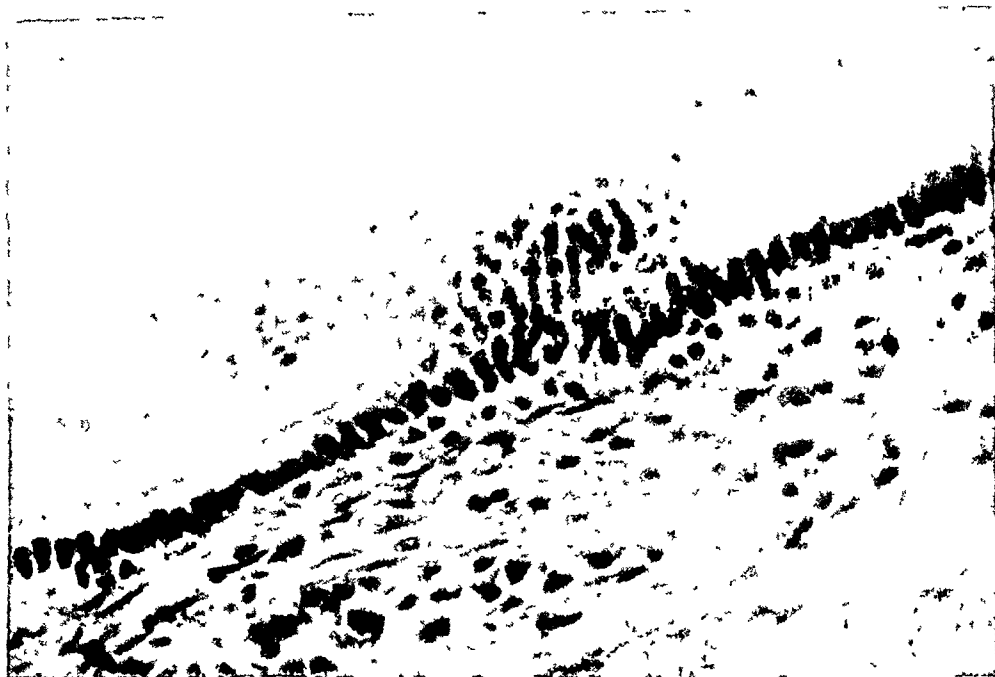


Fig. 22. Another part of the same d. hepaticus as in Fig. 21 showing how the epithelium at a couple of places empties its contents in a cascade into the lumen.



Fig. 23. Persisting slight sclerosis around the finer intrahepatic bile-ducts after cholangiography with sterile 40 % jodairal.

MÄRTENSSON: Cholangitis Following Cholangiography.



Fig. 24. Cholangiolitis 2 days after cholangiography with *E. coli*-infected 40 % Jodairal showing enlarged bile-ducts with swollen partially displaced epithelium with crystals in the lumen (a), diapedesis of leucocytes (b), oedema + purulent exudate in neighbouring liver acinus + inflammation in accompanying vessel (c). Rabbit.

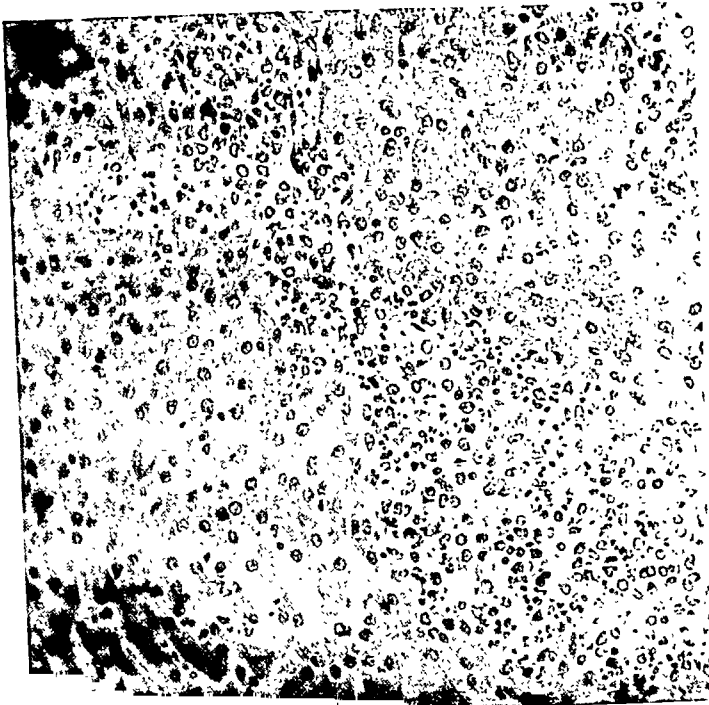


Fig. 25. The strongly exudative (phlegmonous-absceding) cholangiolitic hepatitis after injection of *E. coli* in physiological NaCl (same fluid amount as in cholangiography). 1 day. Rabbit.

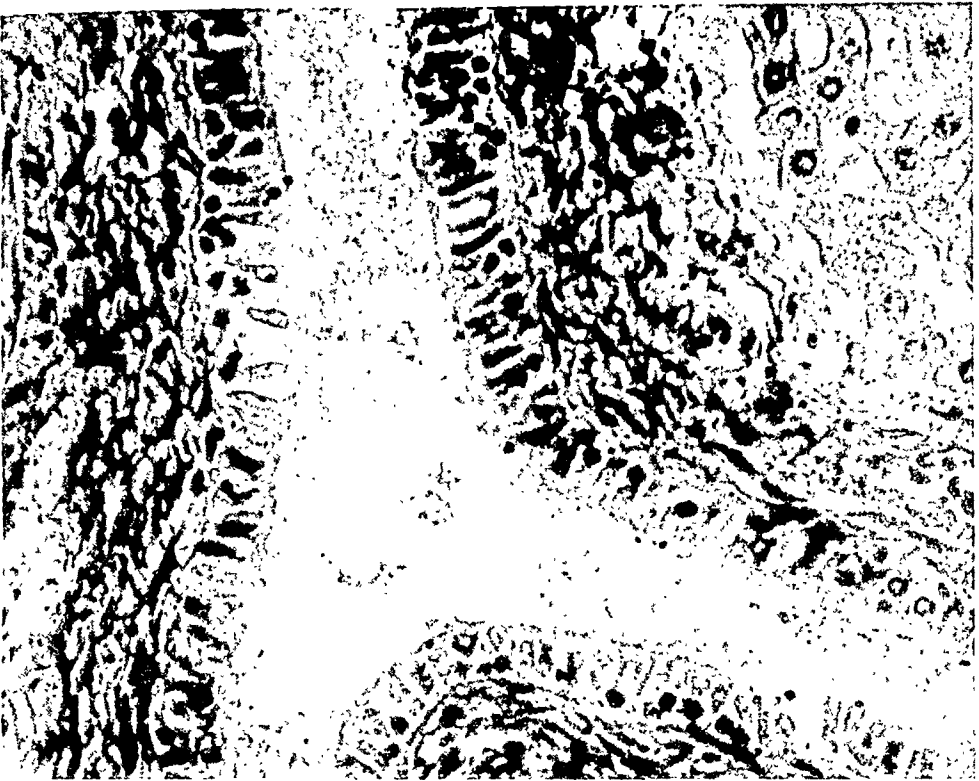


Fig. 26. D. hepaticus branch after cholangiography with sterile perabrodile showing slight vacuolization of the epithelium cells without desquamation. A leucocyte may be seen in the right. Slight oedema.

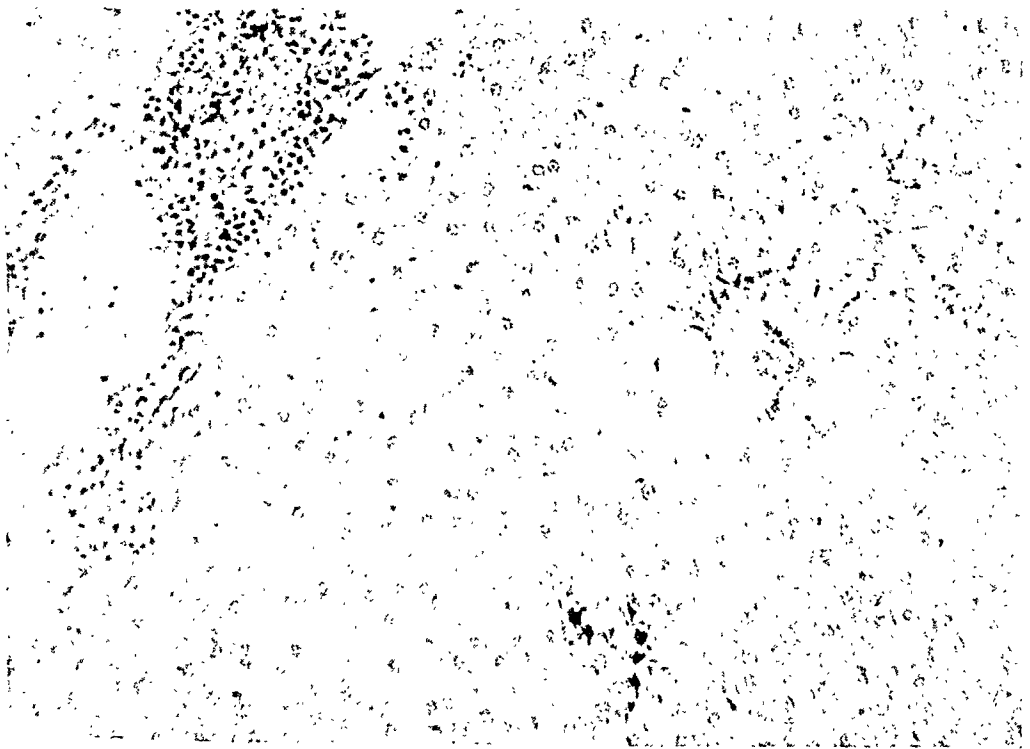


Fig. 27. Shows the strong exudative cholangiolitis after cholangiography with coli-infected perabrodil. Clots in the bile capillaries.



Fig. 28. Bile-ducts and liver of dog 3 weeks after cholangiography with coli-infected perabrodil.

a. normal section surface of injected liver lobe. b. somewhat scarred injected d. hepaticus. c. d. choledochus.

Table 4.

Animal No.	Amount of contrast medium (+ coli-emulsion)	Period of observation	Findings at autopsy			Remarks
			Growth of <i>E. coli</i> from injected parts	Patho-anatomical changes		
				Injected bile-ducts and liver lobes	Not injected ducts and lobes	
<i>Experiments with sterile and E. coli-infected physiological sodium chloride solution.</i>						
R. 1	2.0 ml	2 d.	0	Hepaticus: slight desquamation + oedema. Liver: 0 pathol.	0 pathological	
R. 2, 3, 4, 5, 6	1.2 — 2.0 ml	11 »	0	Hepaticus: possibly slight oedema. Liver: 0 pathol.	»	
D. 10	2.0 + 0.1 ml	3 d.	+++	Purulent cholangitis + diffuse interstitial hepatitis	Slight quite fresh interstitial hepatitis	Lymphogenous pancreatitis. Death
R. 36, 37 .	1.0 + 0.05 ml	1 »	+++	» ; in R. 37 no hepatitis	Hyperemia, otherwise 0	Lymphogenous pancreatitis in R. 37. Both dead

(Cont.)

h

Table 4. (Cont.)

Animal No.	Amount of contrast medium (+ coli-emulsion)	Period of observation	Findings at autopsy			Remarks
			Growth of <i>E. coli</i> from injected parts	Patho-anatomical changes		
				Injected bile-ducts and liver lobes	Not injected ducts and lobes	
<i>Experiments with sterile and E. coli-infected jodairal forte.</i>						
D. 9	2.0 ml	31 d.	0	Coarser bile-ducts: epithelial and subepithelial oedema, epithelium dissolution + nucleus disintegration, oedema + marked sclerosis in the wall. Finer bile-ducts: slight sclerosis	Hepatici: mucous membrane hyperplasia + slight sclerosis. Liver: 0	Specimen from left hepatics
R. 19, 20 .	1.5 ml	3-4 min.	0	Coarser bile-ducts: patchy hyperemia + oedema also sub-epithelial + epithelial membrane rupture	—	Do. from middle hepatics
	1.5 ml	8-10 min.	0	Coarser bile-ducts: violent epithelium exfoliation + slight inflam. reaction	—	Do. from right hepatics
	1.5 ml	15 min.	0	As foregoing + slightly enlarged intrahepatic bile-ducts	—	

R. 21, 22.	1.5 ml	1-2 d.	0	Bile ducts: epithelium swelling + necrosis or sub-epithelial oedema + exfoliation + patchy oedema with plentiful eosinophiles in the wall. R. 22 also microscopic liver necrosis	Unchanged	R. 22 had experimental gallstone
R. 23, 24, 25	2-2.5 ml	8-13 d.	0	In the whole bile tree ulcero-necrotic epithelium changes + wall sclerosis. Liver necrosis with foreign body reaction in one animal	»	One animal spontaneously dead
D. 1, 4	5, 22 ml	6, 15 d.	++	Strong sclerosizing cholangitis. Otherwise 0. Ulcero-necrotic cholangitis with ductogenous liver abscess	»	Bile leakage in D. 1. D. 4
R. 17, 18.	2.0-2.8 ml	1-3 d.	+--+++	» ; 0 parenchymatous injury	Slight subacute hepatitis 0 pathological	Bile leakage in R. 18. Experimental gallstone in R. 17
D. 2, 6 . . .	4-8+0.4 ml	1½-6 d.	++--+++	Grave ulcero-necrotic cholangitis. Slight cholangiolitis in one animal. 0 parenchymatous injury	Unchanged	Choledochus drainage
R. 12	3+0.2 ml	20 h.	+++	Ulcero-purulent cholangitis + cholangiolitis + slightly purulent liver necroses	Hyperemia	Spontaneously dead
R. 14, 15. } R. 13, 16 } D. 3, 8 . . }	1.5-4+0.3 ml 5-10+0.1- -0.4 ml	1-3 d. 18, 60 d. 16, 20 »	++ ++ ++	All of them grave ulcero-necrotic cholangitis with ductogenous liver abscesses (in 1 dog and 1 rabbit with perforation and sub-phrenic abscesses).	Slight interstitial hepatitis in R. 14 and 15. Otherwise 0 pathological	Most of them pleuro-pneumonia on injected side. D. 8 also lymphogenous pancreatitis

Table 5.

Animal No.	Amount of contrast medium (+ coli-emulsion)	Period of observation	Findings at autopsy			Remarks
			Growth of <i>E. coli</i> from injected parts	Patho-anatomical changes		
				Injected bile-ducts and liver lobes	Not injected ducts and lobes	
<i>Experiments with sterile and E. coli-infected 40 % jodairal.</i>						
R. 31	2.0 ml	20 min.	0	Coarser bile-ducts: sub-epithelial oedema, hydropic, partially ruptured epithelium, desquamation in places, hyperemia + oedema in whole bile tree	Unchanged	
R. 32, 57 .	1.0—2.0 ml	1—2 d.	0	Coarser bile-ducts: desquamation + epithelium dissolution + wall oedema. Finer bile-ducts: 0 pathological	0 pathological	
R. 33, 34 .	2.0 ml	12—13 d.	0	Extra-hepatic bile-ducts: hydropic, partially desquamated epithelium. Slight sclerosis. R. 34 sclerosis in whole bile tree	0 pathological	
R. 35, 47 .	2.0 ml	60 d.	0	Hyperemia in coarser bile-ducts. Otherwise 0 pathological	0 pathological	R. 35: experimental gallstone

D. 7 R. 26, 27, 28, 30 . .	2.6+0.2 ml 2.0+0.3 ml	1 d. 1-2 d.	+++ +++	Phlegmonous (= ulcero-gangrenous) cholangitis + cholangiolitis; in all rabbits acinous ductogen hepatitis	Hyperemia + oed- ema in D. 7 and R. 30. Otherwise 0 pathological	Death: D. 7. R. 26, 27, 30. Others ill
R. 29	2.0+0.2 ml	1-2 d.	++	Slight subacute cholangitis	0 pathological	
<i>Experiments with sterile and E. coli infected abrodil, so-called contrast U Leo.</i>						
R. 44, 45 .	1.0-2.0 ml	1-1½ d.	0	Coarser and medium coarse bile-ducts: hydropic, partially necrobiotic and exfoliating epithelium + sub- epithelial and intramural oedema. Otherwise 0 pathological	0 pathological	
R. 46	1.5 ml	7 d.	0	Slight bile-duct sclerosis. Otherwise 0 pathological	Unchanged	
R. 40, 41 .	2.0+0.3 ml	2 d.	+++	Phlegmonous hepato-choledochitis + slight ductogenous hepatitis	Patchy slight he- patitis	

Table 6.

Experiments with sterile and E. coli-infected perabrodil.

Animal No.	Amount of contrast medium (+ coli-emulsion)	Period of observation	Findings at autopsy			Remarks
			Growth of E. coli from injected parts	Patho-anatomical changes		
				Injected bile-ducts and liver lobes	Not injected ducts and lobes	
R. 42, 43, 41	1.8—2.0 ml	1—3 d.	0	Very slight epithelium injuries in hepato-choledochus. One or two round-cells + possibly slight oedema in the wall. Otherwise 0 pathological	0 pathological	
D. 12	2.0 ml	21 d.	0	Extra-hepatic ducts: slight chronic mucous irritation. Otherwise 0 pathological	0 pathological	
R. 38, 39 .	2.0+0.3—0.4 ml	1 d.	+++	Phlegmonous cholangitis + slight exudative cholangiolitis in patches	Slight acute inflammation in hepatic duct in one animal	Subphrenic serositis + basal pleuro-pneumonia on injected side. Death.
D. 11	5.0+0.3 ml	21 d.	++	Slight chronic catarrhal cholangitis	0 pathological	

forte down to 40 % therefore in sterile cases grave persisting injuries to the deep bile-ducts should mostly be avoided but on the other hand ascending coli-cholangitis cannot be avoided in cases with *E. coli* in cystic duct or common bile-duct. Nor in the last named cases would there seem to be any benefit by rinsing out contrast medium after cholangiography with sterile physiological sodium chloride solution, as RUDSTRÖM and others have proposed, as we know that washing up of *E. coli* alone is sufficient to bring out cholangenic hepatitis (see p. 12).

The question then became: What are the effects of abrodil and perabrodil on the bile ducts and the liver? Experiments with these preparations are reported in tab. 5 and 6. The abrodil used is manufactured by A/B Leo, Hälsingborg, Sweden, also called contrast U (monoiodine-metansulfonate of sodium), which in experiments, both sterile and *E. coli* infected, gave in principle the same results as 40 % jodairal (see tab. 5). Sterile perabrodil (Bayer) seemed on the other hand only to produce very slight changes — compared with those following sterile physiological sodium chloride solution (see p. 14) — in the coarser bile-ducts' mucous membranes, consisting mostly in loosening of the epithelium and slight epithelium desquamation (see fig. 26). When *E. coli* is present there also arises post-cholangiographic cholangitis, which in one dog was very slight but in rabbits gave a picture similar to that after injecting *E. coli* alone (see fig. 27), though not quite as violent. This last feature may be due to individual variations or bactericide affect of the perabrodil. In the cases with *E. coli*-infected perabrodil it would seem that the main cause of the post-cholangiographic cholangitis was the mechanical propulsion of the infection.

b. In-Vitro Experiments.

Testing the Bactericide Properties of Various Jodairal Solutions against *E. coli*.

From the animal experiments it would seem to be shown that the more concentrated jodairal forte gave an inflammation more localized to the actual bile-ducts when experimenting with *E. coli* infected fluid while coli-infected 40 % jodairal gave an inflammation recalling more the picture after injection of *E. coli* alone. This would seem to point to a bactericide effect of jodairal against *E. coli*. The writer has therefore done the following test:

A normal loop of *E. coli* from a day old plate culture was blended quickly to homogeneous suspension in each of 4 tubes containing 4 ml of 60 %, 45 %, 40 % and 15 % jodairal respectively, which had been heated to 37°. The tubes were kept in thermostat at 37 and, after

various intervals 0.05 ml of the fluid was spread on Endoagar. Incubation for 24 h, then reading by counting the colonies.

Result: Table 7 shows that *jodairal* has an astonishingly strong bactericide effect in higher concentration and that the bactericide effect is proportional to the concentration of the contrast medium.

Table 7.

In-vitro tests of bactericide effect of jodairal on E. coli.

Time of jodairal action on <i>E. coli</i> after emulsification	Jodairal-concentration			
	60 %	45 %	40 %	15 %
1 min.....	0—+	++	+++	++++
3 "	0	0—++	0—++	++++
5 "	0	0—+	0—++	++++
40 "	0	0	0	++++
Within 24 hours	0	0	0	0

Notes: 0 = 0 growth, + = isolated colonies, ++ = up to 100 colonies, +++ = more than 100 colonies, ++++ = masses of colonies.

The table represents the summary of 3 different tests with different ampoules of contrast medium.

That this effect does not apply fully in vivo would seem to be due to several circumstances. 1. The epithelium-injury seem to arise parallel to the solutions in question attaining their maximum bactericide effect (cf. tab. 4, 5 and 7). 2. In vivo the contrast medium is partially diluted by bile which decreases its bactericide effect, and at least in human beings *E. coli* might conceal themselves in debris which increases the possiblitiy of the *E. coli* evading the bactericide.

In connection with this it is of interest to see *how long the contrast medium remains in the bile-ducts* and is able to apply both its injurious and its bactericide effect. To arrive at an idea of this point there was taken from rabbit 19 and 20 (see tab. 4) a specimen from each injected hepatic duct for microscopic fluoroscopy — the jodairal because of its iodine content being fluorescent —, which was kindly carried out by Dr. STURE HELANDER. It was found that after 3 minutes practically all the jodairal had already left the bile ducts. This still further supports the view that the jodairal does not succeed in developing its maximum bactericide effect against *E. coli* in vivo during cholangiography.

Testing the Osmotic Pressure of the Various Contrast Media.

The first changes arising after cholangiography with jodairal forte and 40 % jodairal are histologically of such a nature that they suggest that it is in the first place an osmotic effect of the

jodairal which gives the injuries in the bile ducts (see p. 14). The osmotic pressure of various contrast media has therefore been determined as follows:

At first determining of the freezing point for the different contrast media. The molar concentration was then determined in the usual way and the osmotic pressure calculated according to the formula

$$p = m \times 0.082 \times T.$$

In this formula p = osmotic pressure at 37° expressed in atmospheres, m = molar concentration per lit. and T = absolute temperature. The formula holds good when the solutions are entirely dissociated. As may be seen from tab. 8 the figures for molar conc. do not represent complete dissociation. The difference, however, is so little that it does not alter the results in principle.

Table 8.

Physical properties of different contrast media employed in cholangiography.

Contrast medium	Freezing point ($^{\circ}\text{C}$)	Molar concentration in mol per liter	Osmotic pressure in atm. at 37°
Jodairal forte (60 % w. urethane)	—5.012	2.69	68.49
Jodairal 60 %	—4.918	2.64	67.21
» 50 %	—4.456	2.40	60.90
» 48 % (hippuran)...	—4.032	2.17	55.09
» 40 %	—3.476	1.87	47.50
» 30 %	—2.831	1.52	38.69
» 20 %	—1.791	0.96	24.52
Perabrodil 35 %	—2.095	1.13	28.62
Diodrast	—2.210	1.19	30.20
Blood	—	—	7.66

The results appear in tab. 8 where comparison is made with the osmotic pressure for blood, which should give an approximate idea of the osmotic pressure of the liver bile. It was found that jodairal forte has app. 9 times greater osmotic pressure than blood, 40 % jodairal between 6 and 7 times and perabrodil app. $3\frac{1}{2}$ times as great osmotic pressure as blood.

These discoveries make the various degrees of injurious effect of the said contrast mediums on the deep bile-ducts during cholangiography quite comprehensible if, as the histological picture indicates, it is assumed that *the injury arises chiefly through osmosis*. Preliminary results of experiments with sterile sodium chloride solutions of the same osmotic pressure as 60 % and 40 % jodairal support this, but show at the same time that *another factor, probably a chemically toxic one is partly responsible*.

3. Prophylaxis against Post-Cholangiographic Bile-Duct Injuries and Ascending Cholangitis.

Seeing that the *aseptic bile-duct injuries* invariably arise, invariably persist and are grave, even attacking the liver parenchyma and above all as they seem to favour the occurrence of a secondary cholangitis (cf. tab. 3 "clinical cases with 0 growth" and tab. 4) both in man and animals following cholangiography with jodairal forte, it seems to me to be beyond doubt that *jodairal forte should be discarded as contrast medium in cholangiography*. Following 40 % jodairal and abrodil Leo there certainly appear as a rule only transitory injuries but, even with these, isolated cases with persistent injuries have been observed. Seeing that perabrodil according to both HULTÉN's and my experiments and the clinical observations in none-infectious cases does not appear to cause injuries of practical significance, it seems to me *advisable that also 40 % jodairal and abrodil or contrast U. Leo should be discarded and only perabrodil be employed in cholangiography*. Now the German perabrodil is not obtainable, but A/B. Pharmacia, Stockholm, Sweden, have according to information succeeded in synthetizing a perabrodil with the same physical properties as the German. The author has been granted permission to test this on animals before it is made available for use on human beings. Preliminary tests with this contrast medium have given promising results.

In *infected cases, especially with E. coli in cystic duct or common bile-duct*, there arises, as was found in animal experiments, regularly ascending cholangitis, irrespective of the contrast medium used, and observations on human beings suggest that the risk of post-cholangiographic cholangitis in these cases is very great. The observations on human beings further indicate that the sole therapeutic measure, at least in cases of infection with *E. coli*, that might be able to prevent this cholangitis taking graver forms, is a primarily undertaken common bile-duct drainage. Animal experiments support this but show also that despite common bile-duct drainage a fairly grave inflammation is developed in the principal bile-duct. As in these cases it is the propulsion of the infection to the finer intrahepatic bile-ducts that is the essential factor, it seems to the author that prophylaxis theoretically can only follow two paths. The one would be, like MIRIZZI, not to inject more than 3—4 ml contrast fluid so that only hepatic and common bile-duct are filled. In this connection it is interesting to note that at ROBIN's clinic, where hippuran (= 48 % jodairal) was employed, a change seems to have been made to such a

principle (see p. 1—2). The author has in two cases tried to do cholangiography with 3—5 ml 40 % jodairal, but the pictures were not satisfactory. The other way is during the operation to make a smear from the contents and the mucous membrane of the cystic duct and after Gram-staining search for bacteria, especially *E. coli*, and in the presence of *E. coli* particularly, refrain from cholangiography or, if this is considered unavoidably necessary, undertake primarily common bile-duct drainagae.

The demonstration of bacteria, particularly *E. coli*, in smears from bile after staining according to Gram, frequently involves great difficulty as Gram-negative crystals and debris may be difficult to distinguish from Gram-negative rods. However, if the specimen is taken with a bile spoon and transferred to a sterile tube containing 10 ml aqua dest., which is heated nearly to boiling point and then centrifuged, it will be found that the bacteria even when occurring sparsely stand out very clearly from other confusing particles, which are then few in number. Still more pure will be the preparation if, instead of water, warm chloroform is used, the smear then being made from the grey slush which floats on the chloroform after centrifuging. However, a culture as a control can be made from the specimen in sterile water.

Finally it should be remembered that rinsing the bile tree with the object of diluting or washing out the contrast cannot be considered advisable in cases with inflammation. Naturally the inflammation is more certain to be propelled into the gall tree while the bactericide effect of the contrast will be smaller, and washing up alone of *E. coli* can give coli-cholangitic hepatitis (see p. 16).

If the technique proposed by the author is employed there should be very few cases where cholangiography with perabrodil could be considered contraindicated because of risk for post-cholangiographic cholangitis, in an operation material where the principle is to operate at "free interval". Coli infection in cystic duct occurs in this case according to the author's investigations only in a couple of percent.

Summary.

1. Cholangiography with jodairal forte produces in the cases with *E. coli* at the place where the cholangiography cannula is introduced, constantly in dogs and rabbits and at least in 50 % of human beings, a grave ascending cholangitis which may lead to death. Even in cases where cholangiography is carried out

with 40 % jodairal = American hippuran, contrast U (abrodil Leo), perabrodil or physiological sodium chloride solution, every one *E. coli* infected, there is obtained constantly in animals post-cholangiographic cholangitis though of another patho-anatomical picture. Experience from the clinical material suggests that this may even occur in human beings.

2. In cases with jodairal forte the post-cholangiographic cholangitis is due to a collaboration of the injurious effect of osmosis (and chemical toxicity?) on the bile-ducts and the propulsion of *E. coli* into the finer intrahepatic bile-ducts; in experiments with 40 % jodairal and with contrast U Leo mainly to upwards propulsion of *E. coli* and with perabrodil probably only to upwards propulsion of *E. coli*.

3. The only means of preventing the postcholangiographic cholangitis taking graver forms involving the liver has both in observations on human cases and in animal experiments proved to be primary common bile-duct drainage. Nevertheless this cannot prevent a grave hepato-choledochitis.

4. Even in cases primarily sterile, jodairal forte and in isolated cases also 40 % jodairal and contrast U Leo produce persistent injury on the deep bile-ducts and possibly liver necrosis in the animals, and both clinical experience and animal experiments indicates that cholangiography with these may secondarily give grave ascending coli cholangitis. On the other hand perabrodil would seem in sterile cases not to produce injuries of practical significance.

5. Jodairal forte, 40 % jodairal (and hippuran) as well as contrast U Leo and similar preparations should not be employed in cholangiography but *e. g.* perabrodil and preparations physically similar to it.

6. In each case of intended cholangiography tests might be taken from the contents of cystic duct and examined for bacteria in Gram-stained smears. Directions for improving the diagnosis with such smears are given. In cases where bacteria, particularly *E. coli*, are found in these preparations, cholangiography should not be done or, if it is considered unavoidable, common bile-duct drainage should be primarily undertaken.

7. Finally it is pointed out that in the material where operation is done at "free interval" the incidence of *E. coli* in cystic duct is only a couple of percent — 2.8 % of the total material cholangiographed — which shows that the cases where cholangiography because of risk for post-cholangiographic coli-cholangitis should not come into consideration are relatively few.

Zusammenfassung.

1. Die Cholangiographie mit 60 %igem Jodairal ruft in denjenigen Fällen, wo an der Einstichstelle für die Cholangiographiekanüle *E. coli* vorhanden sind, beim Hund und Kaninchen regelmässig, beim Menschen jedenfalls in 50 %, eine schwere ascendierende Coli-Cholangitis hervor, die zum Tode führen kann. Auch in denjenigen Fällen, wo zur Cholangiographie 40 %iges Jodairal (= amerikanisches Hippuran), Kontrast U (Abrodil Leo) oder Perabrodil benutzt wird, oder wo man physiologische Kochsalzlösung in entsprechender Weise anwendet, resultiert ausnahmslos in mit *E. coli* infizierten Fällen bei den Versuchstieren eine postcholangiographische Cholangitis, allerdings mit einem anderen pathologisch-anatomischen Bilde. Die Erfahrungen an klinischen Materialgruppen sprechen dafür, dass dies auch beim Menschen vorkommen kann.

2. In Fällen mit 60 %igem Jodairal beruhen die postcholangiographischen Cholangitiden auf einem Zusammentreffen der schädigenden Einwirkung auf die Gallenwege durch Osmose (und chemisch-toxische Reizung) und des Eintreibens der *E. coli* in die feineren intrahepatischen Gallengänge. In Versuchen mit 40 %igem Jodairal und Kontrast U (Leo) trägt hauptsächlich die Verbreitung der besagten Erreger die Schuld, bei Verwendung von Perabrodil wahrscheinlich allein.

3. Als einziges Mittel, um zu verhüten, dass die postcholangiographische Cholangitis bedrohlichere Formen, mit Beteiligung der Leber, annimmt, hat sich sowohl nach Beobachtungen an Patienten als auch in Tierversuchen die primäre Anlegung der Choledochusdrainage erwiesen. Auch diese vermag jedoch bei bestehender Coli-Infektion nicht eine schwere Hepato-Choledochitis zu verhindern.

4. Selbst in primär sterilen Fällen löst 60 %iges Jodairal — in vereinzelt Fällen auch 40 %iges Jodairal und Kontrast U (Leo) — bei den Versuchstieren eine schwere Dauerschädigung der tiefen Gallenwege sowie unter Umständen Lebernekrosen aus, und sowohl klinische Erfahrungen wie Tierversuche deuten darauf hin, dass sich aus diesen Veränderungen sekundär bedrohliche aufsteigende Coli-Cholangitiden entwickeln können. Perabrodil dagegen scheint bei sterilen Fällen keine Schädigungen von praktischem Belang hervorzurufen.

5. Verf. schlägt vor, Jodairal forte, 40 %iges Jodairal (und Hippuran) sowie Kontrast U (Leo) und ähnliche Präparate nicht

zur Cholangiographie zu benutzen, sondern lediglich Perabrodil und diesem physikalisch gleichwertige Mittel.

6. Verf. empfiehlt, in jedem Fall bei beabsichtigter Cholangiographie Proben von dem Inhalt des Ductus cysticus zu entnehmen und in nach Gram gefärbten Ausstrichen auf die Anwesenheit von Bakterien zu untersuchen. Es wird ein Verfahren zur Verschärfung der Diagnostik mittels derartiger Ausstrichpräparate angegeben und vor der Cholangiographie bei Fällen mit Bakterien, namentlich *E. coli*, in diesen Präparaten gewarnt; erscheint die Cholangiographie unvermeidlich, so soll primär die Choledochus-drainage angelegt werden.

7. Schliesslich wird darauf hingewiesen, dass die Häufigkeit des Vorkommens von *E. coli* im Ductus cysticus in denjenigen Materialgruppen, in welchen die Operation im freien Intervall vorgenommen wird, nur ein paar Prozent von sämtlichen Fällen beträgt; dies steht auf der einen Seite im Einklang mit dem an Hand des vorliegenden klinischen Materials schätzungsweise ermittelten Risiko der postcholangiographischen Cholangitis — 2.8 % für das Gesamtmaterial cholangiographierter Fälle — und macht auf der anderen ersichtlich, dass die Zahl der Fälle, bei denen die Cholangiographie wegen der Gefahr der postcholangiographischen Coli-Cholangitis nicht in Betracht kommen darf, verhältnismässig gering ist.

Résumé.

1. La cholangiographie au «Jodairal forte», lorsqu'il existe des coli-bacilles dans la voie biliaire où l'on introduit la canule à cholangiographie, provoque de façon constante chez le chien et le lapin, et en tout cas chez 50 % des humains, une cholangite ascendante grave à coli, qui peut entraîner la mort. Même dans les cas où la cholangiographie est pratiquée avec du Jodairal à 40 % (identique à l'Hippuran américain), du Kontrast U (Abrodil, Leo), du Perabrodil ou de la solution physiologique de chlorure de sodium, on obtient constamment chez les animaux en expérience, s'ils sont infectés de coli-bacilles, une cholangite postcholangiographique, quoique avec une image anatomo-pathologique différente. L'expérience clinique fait penser que cela peut se produire même chez l'homme.

2. Avec le «Jodairal forte» les cholangites post-cholangiographiques sont causées par la combinaison d'un effet nocif d'ordre osmotique (+ une irritation chimico-toxique?) sur les voies bi-

liaires, avec l'injection des coli-bacilles jusque dans leurs fines ramifications intra-hépatiques. Dans les essais avec du Jodairal à 40 % et du Kontrast U, Leo, elles sont dues surtout au refoulement des coli; et avec le Perabrodil elles ne sont vraisemblablement attribuables qu'au refoulement seul.

3. Le seul moyen d'empêcher la cholangite post-cholangiographique de revêtir des formes très graves et d'attaquer le foie c'est, tant d'après les observations humanines que d'après les essais sur les animaux, d'établir d'emblée un drainage du cholédoque. Mais cette mesure ne semble cependant pas capable de prévenir une hépato-cholédocite sévère.

4. Dans les cas primitivement stériles le «Jodairal forte», et parfois même le Jodairal à 40 %, ainsi que le «Kontrast U», Leo, provoquent des lésions durables des voies biliaires profondes chez les animaux en expérience. Après «Jodairal forte» les lésions sont sévères et souvent associées à des nécroses du foie. Tant l'expérience chez l'homme que celle chez l'animal porte à croire qu'elles peuvent donner secondairement de graves cholangites à coli. En revanche le Perabrodil, dans les cas stériles, ne semble pas causer de dommage revêtant une importance pratique.

5. L'auteur propose qu'on renonce, pour la cholangiographie, au «Jodairal forte», au Jodairal à 40 % (et à l'Hippuran) ainsi qu'au «Kontrast U», Leo, et aux préparations semblables, pour se servir uniquement de Perabrodil et de produits physiquement équivalents.

6. Chaque fois qu'on envisage une cholangiographie il propose de faire un prélèvement du contenu du canal cystique et d'y rechercher les bacilles sur frottis direct après coloration au Gram. Il indique comment améliorer le rendement diagnostique de ces frottis directs. Lorsqu'on y trouve des bacilles, et spécialement des coli, il faut renoncer à la cholangiographie, ou bien, si l'on la considère comme indispensable, établir d'emblée un drainage du cholédoque.

7. Finalement il fait remarquer que dans le matériel des opérations à froid la fréquence du coli dans le canal cystique, n'ascende qu'à 2—3 pour cent de l'ensemble des cas, ce qui d'une part cadre bien avec le risque de cholangite post-cholangiographique tel qu'il fut estimé dans le présent matériel clinique — 2.8 % de tous les malades cholangiographiés — et d'autre part montre que les cas où la cholangiographie ne peut entrer en question à cause de risque d'angiocholite sont relativement peu nombreux.

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Zur Klinik und Therapie der Rippen- tuberkulose.

Von

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In dem jetzt wohl beigelegten Kampf zwischen der konservativen und der radikalen Schule betreffs der Behandlung der — weniger glücklich — sogenannten »chirurgischen« Tuberkulose (Tb) stand eine Form von Knochentb. ausserhalb der Diskussion. Seit KÖNIGS Arbeit vom Jahre 1906 über die Tuberkulose der Thoraxwand besteht nämlich Einigkeit darüber, dass bei der Rippentuberkulose (Rtb.) aus anatomischen wie klinischen Gründen die radikale operative Therapie die Methode der Wahl ist. Jeder, der sich mit der Behandlung dieser Form von Knochen- tb. beschäftigt hat, wird aber Enttäuschungen erlebt haben: der Eingriff ist nicht radikal gewesen, es sind langwierig sezernierende Fisteln entstanden, es ist zu Früh- oder Spätrezidiven gekommen usw. Es überrascht zu sehen, wie selten einem in dem sonst reichen Schrifttum über Knochen- und Gelenktb. Angaben bezüglich der Rippenlokalisation und ganz besonders bezüglich der Behandlungserfolge dieser Form von Knochentb. begegnen.

KÖNIGS (1906) Arbeit umfasst 110 Fälle. Er hatte eine primäre Sternllichkeit von 4 Fällen, und von den übrigen 84 Fällen, bei denen die Resectio costae gemacht worden war, waren bei der Entlassung 62 (74 %) geheilt und 22 nicht geheilt, während von den 22 Fällen mit blosser Auskratzung 11 geheilt und 11 nicht geheilt waren. Eine Nachuntersuchung liegt dieser Arbeit nicht vor. TIXIER u. THEVENOT (1910) berichten über 14 Fälle von Rtb., von denen 12 reseziert und 2 nur

ausgekratzt worden sind, ohne jedoch exakte Angaben über die Behandlungsergebnisse zu machen. WEICHARDT (1916) hat 22 Fälle mitgeteilt: in 13 Fällen wurde die radikale Resektion gemacht, in 8 Fällen bloss ausgekratzt, 70 % bzw. 30 % der Fälle waren nach 6½ Jahren Beobachtungszeit geheilt. In seiner berühmten Arbeit über die Knochen- und Gelenktb. des Kindesalters hat SVEN JOHANSSON (1924) 17 Fälle, bei denen die Rippentb. als Hauptübel aufgefasst ist, wozu noch 3 Fälle kommen, bei denen sie eine Komplikation einer anderen Tb. war. Sämtliche Fälle sind operativ behandelt, davon 9 mit Resektion und Primärsutur, 11 mit Auskratzung; von den letzteren sind 2 verstorben, während die übrigen bei der Nachuntersuchung 1—13 Jahre nach dem Eingriff geheilt waren. Im übrigen hat man — soweit ich habe sehen können — auf die gerade in dieser Spezialfrage recht knappen Angaben der Monographien und Handbücher verwiesen, während man der Frage nach der Entstehung der Rtb. im Schrifttum etwas stärkeres Interesse entgegengebracht hat (HENSCHEN 1925, SCHREIBER 1926, CHARLIN 1937, MÜHLFELDER 1938 u. a.).

Aus diesen Gründen erschien es von Interesse, die in der Chirurgischen und der Orthopädischen Klinik zu Lund über Klinik und Therapie bei dieser wenig beachteten Form von Knochentb. gemachten Erfahrungen vorzulegen.

Das Material stammt aus den Jahren 1919—1938. Diese Zwanzigjahresperiode wurde gewählt im Hinblick auf die Exaktheit der Diagnostik und um eine genügend lange Observationszeit bei der Nachuntersuchung, die im Mai/Juni 1943 vorgenommen wurde, zu haben. Das Material umfasst 75 Fälle, davon 45 Männer und 30 Frauen; das Geschlechtsverhältnis ist also 3 : 2, während z. B. KÖNIG ungefähr gleich starke Frequenz beider Geschlechter meldet. Eine pathologisch-anatomische Untersuchung ist in 50 Fällen gemacht worden. In 40 Fällen — 53 % des Materials — war die path.-anat. Diagnose eindeutig positiv, in den übrigen 10 Fällen erhob die Untersuchung unsichere histologische Befunde; nach den übrigen Umständen aber handelt es sich auch bei ihnen um eindeutige Tb.-Fälle. In 25 Fällen — hauptsächlich aus dem Anfang der Untersuchungsperiode — ist die mikroskopische Untersuchung unterblieben, doch steht die Diagnose in Anbetracht der vorliegenden Daten in sämtlichen Fällen ausser Zweifel; 3 zweifelhafte Fälle mit nicht ganz klarer Ätiologie sind lieber ausgeschlossen worden.

In 68 Fällen war der krankhafte Vorgang auf Rippen bzw. Rippenknorpel beschränkt, während in 6 Fällen auch das Sternum und in einem Fall das Schlüsselbein ebenfalls beteiligt war. Wie KÖNIG finden wir, dass die Rippen 5—8 mit 60 % der Fälle am häufigsten der

Sitz der Tuberkulose sind. Multiple Lokalisation war in wenigstens 17 Fällen, wahrscheinlich in noch weit mehr, zu verzeichnen. Denkt man sich den Brustkorb durch die Axillarlinie in 2 Hälften geteilt, so ist der Sitz der Rtb. in 64 Fällen die vordere und nur in 11 Fällen die hintere Hälfte. Die Verteilung ist also in unserem Material im Verhältnis 6 : 1, während KÖNIG nur »wohl doppelt soviel vordere Erkrankungen« fand.

Nach KREMER u. WIESE ist die Rtb. am häufigsten im 10.—14. Lebensjahre, eine Angabe, die auf unser Material in keiner Weise zutrifft. Das Durchschnittsalter sämtlicher Patienten errechnet sich hier nämlich mit 39 ± 2.3 Jahren. Die Alterskurve stimmt auch nicht mit der von WALLGREN u. LUNDBLOM (1935) gegebenen überein, die sich auf 2,031 Fälle von Knochen-Gelenktb. aus Schwedischen Krankenhäusern stützte. Während in dem Material der genannten Autoren nur 12 % der Fälle auf die Altersgruppen über 40 Jahren entfallen, verzeichnen wir nicht weniger als 45 % oberhalb dieser Altersgrenze. Diese ungewöhnliche Altersverteilung lässt sich nicht gut als ein blosser Zufall ansprechen, andererseits aber ist es schwierig, eine befriedigende Erklärung zu finden. Mit Rücksicht auf die erwiesene Abnahme der Knochen-Gelenktb.-Häufigkeit in dem hier berühmten geographischen Gebiet ist es von Interesse festzustellen, ob die Altersverteilung in den 20 Jahren der Untersuchungsperiode irgendwie schwankt. Sichere Variationen lassen sich nicht feststellen; die Altersverteilung in den einzelnen Jahrfünften zeigen — möglicherweise mit Ausnahme des ersten, dessen Kurve mehr an die WALLGREN-LUNDBLOMSche erinnert — denselben Typus wie die Hauptkurve. Das Material wird ja pro Jahrfünft ziemlich klein, doch dürfte man die Zeit nicht als irgendwie belangvollen Faktor in Betracht zu ziehen brauchen. WALLGREN u. LUNDBLOM haben gezeigt, dass praktisch sämtliche Fälle von Knochen-Gelenktb. binnen 3 Jahren nach Manifestation der Tb.-Infektion auftreten. Die von ihnen gebotene Alterskurve deutet ihres Erachtens nicht auf irgendeine besondere Empfänglichkeit in bestimmten Altersgruppen, vielmehr entspricht die Morbiditätskurve recht gut der Kurve primärer Tb.-Infektionen in den betreffenden Jahresgruppen. Die Altersverteilung unseres Materials könnte andeuten, dass in unserer Klientel das Risiko einer Tb.-Infektion praktisch das ganze Leben hindurch etwa dasselbe ist. In diesem Zusammenhang muss darauf hingewiesen werden, dass die Patienten der hiesigen Chirurgischen und Orthopädischen Klinik überwiegend der Landbevölkerung angehören und dass Tiertuberkulose im Aufnahmebereich dieser

Kliniken stark verbreitet ist. Wie dem auch sei, jedenfalls zeigt unser Material, dass — wenigstens in dem in Rede stehenden geographischen Gebiet — in sämtlichen Altersgruppen etwa dieselbe Wahrscheinlichkeit einer Rtb. besteht, eine Feststellung, die von einem gewissen differentialdiagnostischen Interesse sein kann.

Vom klinischen und therapeutischen Gesichtspunkt aus scheint indessen das wesentliche Einteilungsprinzip ein anderes zu sein als Geschlecht, Alter und Lokalisation. Unser Material gliedert sich recht zwanglos in zwei Hauptgruppen: 1) Fälle, bei denen die Rtb. nur eine Episode in einem längeren oder kürzeren Tb.-Leiden ist, und 2) Fälle, bei denen die Rtb. *die* tuberkulöse Krankheit ist. Rtb. ist, man kann wohl sagen nie primär in dem Sinne, dass sie die erste Tb.-Manifestation ist, doch ist sie in einer gewissen Anzahl von Fällen die vom klinischen Gesichtspunkt einzig bestehende Form dieser Krankheit, selbst wenn man durch die Röntgenuntersuchung oder bei einer etwaigen Obduktion noch andere Tb.-Herde aufzeigen könnte und es in den meisten Fällen auch kann. Mit Hilfe der Röntgenuntersuchung hat man derartige Veränderungen in einem hohen Prozentsatz nachweisen können — so findet SVEN JOHANSSON Lungenveränderungen irgendwelcher Art in 44 % seines Materials —, wenn auch die Zahlen in verschiedenen Statistiken erheblich wechseln (SNYDER 1933, MENG u. CHEN 1935, DUNCAN 1937 u. a.). Vom immunbiologischen Gesichtspunkt aus besteht indessen aller Erfahrung nach ein höchst wesentlicher Unterschied zwischen diesen Fällen mit latenten Herden und denen mit manifester Tuberkulose. In unserem Material hat in nicht weniger als 31 Fällen — also 41 % — eine andere, aktuelle oder überstandene, *klinische* Tb. vorgelegen, eine sehr hohe Zahl. In 15 von diesen Fällen hat multiple Tb. bestanden. In 16 Fällen hat eine andere Knochen-Gelenktb. vorgelegen — also bei mehr als einem Fünftel des ganzen Materials —, in 11 Fällen eine Urogenitaltb. und in 16 Fällen klinisch aktive Lungentb. Die einzige vergleichbare Angabe, die ich habe finden können, ist die von SVEN JOHANSSON, dass in 5 von seinen 20 Rtb.-Fällen noch andere Knochentb. vorgelegen hat, in einem Fall Lymphome und in einem Verdacht auf Lungentb. Diese Zahlen sind in beiden Zusammenstellungen von derselben Grössenordnung — 30 % bzw. 41 % — und *unterstreichen die Bedeutung einer sorgfältigen Allgemeinuntersuchung bei jedem Fall von Rtb.*

Die Wichtigkeit dessen ergibt sich unmittelbar bei der Nachforschung.

Diese ist in der Weise erfolgt, dass an die zuständigen Pfarrämter Fragebogen geschickt wurden, durch die der jetzige Aufenthaltsort der ehemaligen Patienten bzw. der Sterbtag und die *Todesursache* erfragt wurde. In den Landgemeinden Schwedens bedarf es keines ärztlich ausgestellten Totenscheines, weshalb in vielen Fällen nur der Vermerk des Pfarrers über die vermutliche Todesursache zur Verfügung steht. Durch diese Fragebögen haben sämtliche Patienten mit Ausnahme von zweien aufgespürt werden können, so dass die Nachforschung 97 % des Materials umfasst. Alle noch lebenden Patienten haben einen Fragebogen bekommen, in dem um Angaben über etwaige Rezidive, etwaige Tb. mit anderer Lokalisation, andere Krankheiten und die jetzige Arbeitsfähigkeit gebeten wurde. Alle Befragten haben die Antworten eingeschickt.

Die *Prognose* der Rtb. wird in den Handbüchern als gut bezeichnet. Es überraschte daher, dass von den 73 durch die Nachforschung erfassten Patienten nicht weniger als 34 — d. h. 47 % von diesen und 45 % des Gesamtmaterials — verstorben sind. In 21 Fällen war die Todesursache mit Bestimmtheit Tb. — also in 62 % der Sterbefälle und in 29 % des Gesamtmaterials. In den restlichen 13 Sterbefällen kann Tb. als Haupttodesursache ausgeschlossen werden, wenn auch wahrscheinlich die Tb. in einigen von diesen Fällen wenigstens mit zum tödlichen Ausgang beigetragen hat. Diese gemeinhin als recht unschuldig betrachtete Lokalisation von Knochen-Tb. ist also mit einer erschreckenden Mortalität belastet. Bei einer eingehenderen Analyse des Materials nimmt sich das Bild vom prognostischen Gesichtspunkt auch etwas anders aus. Teils bringt es die Altersverteilung mit sich, dass im Laufe der relativ langen Nachuntersuchungsperiode naturgemäss einige Patienten verstorben sein müssen, die also keine Übersterblichkeit darstellen. Teils sind die Sterblichkeitszahlen in den beiden Gruppen mit und ohne manifeste Tb. erheblich verschieden. Von den 31 Patienten der ersteren Gruppe sind 17 inzwischen verstorben und einer nicht aufgefunden worden. Die Sterblichkeitszahl ist hier also 55 %. Die Todesursache war in 14 Fällen Tb. — 83 % der Sterbefälle und 45 % aller Fälle dieser Gruppe. Von den 44 Patienten der Gruppe ohne manifeste Tb. sind ebenfalls 17 verstorben und einer nicht aufgefunden worden. Die Sterblichkeitszahl ist auch hier von derselben Grössenordnung (die Altersverteilung beider Gruppen ist etwa die gleiche) — 40 % — doch ist die Todesursache nur in 7 Fällen Tb., d. h. bei nur 41 % der Verstorbenen und 16 % der Gruppe. Die statistische Analyse zeigt (Diff. 29 % \pm 10.8 %), dass die Tb.-Sterblichkeit in der

ersteren Gruppe wahrscheinlich grösser ist als in der letzteren, wie ja auch von vornherein zu erwarten war.

Bei einer Beurteilung der *Diagnose* wie auch der *Therapie* muss auf die hier dargelegte Verschiedenheit in der Zusammensetzung des Materials Rücksicht genommen werden. Ist an einer anderen Stelle des Körpers ein einwandfreier tuberkulöser Prozess zu verzeichnen — entweder in der Krankengeschichte oder noch im Gange befindlich —, so versteht sich die Diagnose des kalten Abszesses in den meisten Fällen von selbst. Sonst kann es nicht selten — wie die Krankengeschichten ausweisen — erhebliche Schwierigkeiten bieten, die richtige Diagnose zu finden. Der Beginn der Rtb. ist in der Regel ganz insidiös, und in 38 der Fälle, in denen Angaben über den Beginn der Krankheit vorliegen, war zufällig ein »Knoten« entdeckt worden, gewöhnlich an der Brust — also ein Weichteilabszess als Zeichen eines pathologisch-anatomisch gesehen recht fortgeschrittenen Knochenvorganges. Differentialdiagnostisch kommen demnach besonders bei den Frauen Mammargeschwülste in Frage, und in wenigstens zwei Fällen lautete die primäre Diagnose auf Brustkrebs, während der wahre Sachverhalt erst bei der Operation aufgedeckt wurde. In 15 Fällen sind als erste Krankheitserscheinung jedoch *Schmerzen* verzeichnet, bisweilen mehr diffusen und unbestimmten Charakters, bisweilen heftigerer Art. Solange nicht ein kalter Abszess vorliegt, kann man die richtige Ätiologie nur vermuten. STAEHLIN (1940) hat auch die Möglichkeit harmloser Rippenperiostitiden als Ursache von Beschwerden dieser Art hingewiesen. Diejenigen Fälle, bei denen die Rtb. mit akuterem, stärkeren Schmerzen einsetzt, können, falls die unteren Rippen angegriffen sind, als akute Baucherkrankungen — Cholecystitis o. dgl. — erscheinen, was von einem gewissen differentialdiagnostischen Interesse ist. Rippenosteitiden von anderer als tuberkulöser Ätiologie sind selten und kommen daher differentialdiagnostisch kaum in Betracht. Während des hier behandelten Zeitraums sind luische Rippenprozesse in 4 Fällen vorgekommen, septische Osteitiden in 6 Fällen, davon in 2 Fällen sekundär zu Empyemen, in den übrigen 4 Fällen primär. Klinisch deckten sich diese letzteren Fälle durchaus mit den Tb.-Osteitiden, die Diagnose gründet sich auf die pathologisch-anatomische Untersuchung, evtl. durch die Bakterienkultur vervollständigt. Vom Gesichtspunkt der Behandlung aus hat die ätiologische Diagnose nur geringes Interesse, denn auch in den septischen Fällen ist eine primäre Resektion vorzuziehen (siehe unten).

Versicherungsmedizinisch ist der Umstand von Bedeutung dass in nicht ganz wenigen Fällen der Kranke ein Trauma als wesentlichen ätiologischen Faktor nennt. So ist in unserem Material in 13 Fällen — nicht ganz einem Fünftel des Materials — äussere Gewalt mehr oder weniger direkt als Ursache des Rippenprozesses angegeben worden. In 12 Fällen handelte es sich um direkte Gewalt gegen die Brust — nach Grad und Art sehr verschieden, vom Stoss eines Stiers bis hin zum »Anstossen« an einem Topfrand, in einem Fall ein »chronisches Trauma« durch Aufdrücken der Brust auf eine Bohrmaschine —, während in dem dreizehnten Fall indirekte Gewalt angegeben wurde, nämlich eine »Zerrung« beim Heuladen. Ohne hier auf die Frage Trauma-Tb. eingehen zu wollen, kann man sagen, dass schon der Faktor der Zeit in 8 Fällen einen Kausalzusammenhang ausschliesst, da in 7 Fällen ein »Knoten« nur ein paar Tage bis eine Woche nach dem Trauma auftrat, in dem achten Fall dagegen 8—9 Jahre später. Wenigstens in den ersten 7 Fällen hatte die Gewalt mit Bestimmtheit nur die Bedeutung, dass sie das Übel in dem Sinne lokalisierte, dass die Aufmerksamkeit auf den Prozess gelenkt wurde. In 4 Fällen war das zeitliche Intervall von einer Grössenordnung, die einen Zusammenhang zwischen Trauma und Prozess nicht ausschliesst, während in dem restlichen Falle so unbestimmte Angaben gemacht wurden, dass kein sicheres Bild des Sachverhaltes zu erlangen ist.

Das hier Gesagte zeigt, dass die *Länge der Anamnese* — also die Zeit, die die Kranken vom subjektiven Bewusstwerden des Übels bis zum Besuch des Arztes verstreichen lassen — hier ebenso wie nicht selten bei Knochen-Gelenktb. für die Frage nach dem Alter des tuberkulösen Prozesses von verhältnismässig geringer Bedeutung ist. Vom *röntgendiagnostischen* Gesichtspunkt aus ist es jedoch von Interesse, die fraglichen Verhältnisse zu registrieren, da ja die Zeit ein Faktor ist, der bei Knochenprozessen wesentlich die Bedeutung dieser Untersuchungsmethodik beeinflusst. 59 Fälle — also annähernd vier Fünftel des Materials — sind auf das Vorkommen von Rippenherden röntgenuntersucht worden. In der Regel bezeichnet man die Möglichkeiten einer Röntgendiagnose gerade bei dieser Lokalisation der Knochentb. aus offenkundigen anatomischen und technischen Gründen als besonders gering. Es ist daher eine Überraschung, feststellen zu können, dass in 21 Fällen — d. h. in mehr als einem Drittel sämtlicher röntgenuntersuchter — eine positive Röntgendiagnose gestellt wurde. In 14 Fällen haben wir sichere Herdveränderungen

— 4 dieser Fälle gehören jedoch zu den 6, bei denen auch das Sternum beteiligt war, so dass also nur 10 Rippenherde vorliegen —, während in 4 Fällen verdächtige Rippenveränderungen als Stütze einer topischen Diagnose bestanden. In 2 Fällen konnte man Verkalkungen in einem Weichteilschatten verzeichnen, was röntgenologisch den Verdacht auf Tb. weckte. In einem Falle schliesslich hat man das Vorhandensein eines intrathorakalen Abszesses von typischem Aussehen beobachtet (SKARBY 1938). Dass es andere Faktoren als rein röntgentechnische sind, welche die Möglichkeiten einer positiven Diagnose bedingen, scheint aus dem Umstand hervorzugehen, dass trotz der gewaltigen Fortschritte der Röntgendiagnostik sich die Zahl der diagnostizierten Fälle gleichmässig auf die einzelnen Jahrfünftel verteilt, abgesehen von den Jahren 1919—1923, wo keine positive Herddiagnose gestellt wurde. Aus einem Vergleich zwischen der Länge der Anamnese und das Verhältnis zwischen röntgenpositiven Fällen geht hervor, dass die Gruppe 0—3 Mon. prozentual gleich viele röntgenpositive Befunde aufweist wie die Gruppen mit längerer Krankheitsgeschichte. Dies unterstreicht, was schon das klinische Bild gezeigt hat, nämlich dass der Rippenprozess schon bei seiner Entdeckung in der Regel, pathologisch-anatomisch gesehen, »alt« ist.

Dies ist eine wichtige Feststellung von grösster Bedeutung für das therapeutische Handeln. Von anderen Lokalisationen von Knochen-Gelenktb. her ist uns wohl bekannt, dass der krankhafte Vorgang nach Möglichkeit gewisse immunbiologische Gleichgewichtslage im angegriffenen Organismus hervorgerufen haben soll, bevor wir zum operativen Eingreifen schreiten. Unsere gesamte allgemeine konservative Behandlung läuft bekanntlich darauf hinaus, die Erreichung gerade dieses Gleichgewichtes zu unterstützen. Doch kann man sich des Eindrucks nicht erwehren, dass diesen Dingen bei der Behandlung der Rtb. zu geringe Beachtung geschenkt wird. Es liegt aber klar zu Tage — wie auch die Frequenzzahlen anderer Tb. in diesen Fällen noch herausstellen —, dass die Allgemeinbehandlung auch bei der Rtb. dieselbe Bedeutung hat wie bei jeder anderen »chirurgischen« Tb. Gerade die oben gemachte Feststellung, dass der Rippenprozess in der Regel ziemlich alt sein dürfte, liesse sich als Grund dafür angeben, weshalb die Behandlung doch in den meisten Fällen erfolgreich ist. Die Erklärung der Misserfolge kann vielleicht zum Teil anderweitig zu suchen sein.

Tabelle 1.

Das Behandlungsergebnis bei den 61 nachuntersuchten chirurgisch behandelten Patienten.

Primärer Eingriff	Ergebnis			Neuer Eingriff	Ergebnis		Weitere Eingriffe
	Geheilt	Nicht geheilt	Rez.		Geheilt	Rez.	
Inzision 12	1	1	10	Auskratzung 2	1	1	Fall 60: 2 Resektionen u. 1 Exstirpation
				Resektion 8	6	2	Fall 30: 1 Resektion Fall 59: 5 Resektionen
Auskratzung 5	0	1	4	Auskratzung 3	3		
				Resektion 1	—	1	Fall 77: 1 Resektion + 1 Inzision
Resektion 44	31	10	3	Inzision 1	—	1	Fall 6: 2 Resektionen + 2 Inz.
				Resektion 2	2	—	
61	32	12	17		12	5	

Die *Behandlung* war im vorliegenden Material weitgehend operativ. In 6 Fällen ist jedoch kein Eingriff unternommen worden, während in weiteren 6 Fällen bloss wiederholte Punktionen des Thorakalabszesses gemacht worden sind. Von diesen 12 Patienten haben aber bloss 4 eine regelrechte konservative Behandlung erhalten — die übrigen sind aus verschiedenen Gründen nur kurze Zeit im Krankenhaus gewesen. Von diesen 4 Patienten, die alle auch andere Knochen-Gelenktb. hatten, wurden 3 als geheilt entlassen, während einer der Tb. erlag. Von den übrigen waren 7 bei der Entlassung nicht geheilt, während einer im Krankenhaus an Tb. starb. Bei der Nachuntersuchung lebten 5 gesund und geheilt, während 5 inzwischen verstorben waren; unter den Überlebenden befanden sich die drei konservativ behandelten. Die Zahlen sind selbstverständlich zu klein, als dass sie Schlüsse erlaubten, doch zeigen die Fälle immerhin, dass man auch ohne chirurgisches Eingreifen eine Heilung von Rtb. bei einer Observationszeit von 22—15 Jahren erzielen kann.

Als einziger operativer Eingriff ist in 6 Fällen Auskratzung gemacht worden, während in den übrigen 57 Fällen — also in 76 % des Materials — die Rippenresektion mit radikaler Absicht vorgenommen worden ist. Was die Technik angeht, sei hier nur erwähnt, dass versucht worden ist, nach Möglichkeit Abszessmembranen und Fisteln zu exstirpieren, worauf die Wunde mit Jodoformgaze tamponiert wurde; in einer Anzahl von Fällen wurde die Wunde jedoch primär geschlossen.

Es bietet recht beträchtliche Schwierigkeiten, den Verlauf und die Behandlungsergebnisse zu veranschaulichen. Zu einem Teil liegt dies daran, dass ein so grosser Prozentsatz der Patienten inzwischen verstorben ist; es war unmöglich, bezüglich dieser Fälle Aufschlüsse über die Lage der Rippenkrankheit vor dem Tode zu erhalten, weshalb eine recht erhebliche Lücke in der Materialanalyse besteht. Eine weitere Schwierigkeit ist das Auftreten von Früh- und Spätrezidiven, von denen manche in die Observationsperiode fallen — d. h. die betreffenden Patienten haben sich zu erneuter Behandlung eingefunden —, während andere erst während des Nachuntersuchungstermins auftreten. Die Ergebnisse der chirurgischen Therapie sind indessen in Tab. 1 zusammengefasst, in welche Tabelle auch die Ergebnisse der Nachuntersuchung eingearbeitet worden sind.

Der Primäreingriff war die erste chirurgische Massnahme, unabhängig davon, ob sie in der Chirurgischen oder Orthopädischen Klinik oder anderswo durchgeführt worden ist. Soweit sich aus den Krankenblättern ersehen lässt, sind die *Inzisionen* wahrscheinlich meist auf eine andere Diagnose hin gemacht worden, während die Ätiologie erst durch das Rezidiv klargestellt worden ist. Als »nicht geheilt« werden Fälle bezeichnet, die bei der Entlassung noch Fisteln hatten, während »Rezidiv« die Bezeichnung für Fälle ist, die wenigstens für einige Zeit nach dem Eingriff geheilt waren. Die »nicht geheilten« stellen ein Moment der Unsicherheit dar, da diese Gruppe Fälle umfasst, die verhältnismässig kurze Zeit — meistens binnen $\frac{1}{2}$ —1 Jahr — nach dem Eingriff tödlich ausgegangen sind, bei denen also die Observationszeit kaum genügt hat. Die meisten Entlassenen sind wahrscheinlich zu fortgesetzter poliklinischer Behandlung bestellt worden, doch war es infolge technischer Schwierigkeiten nicht möglich, sie weiter zu verfolgen.

In 12 Fällen war der primäre Eingriff eine *Exstirpation* o. dgl. Von diesen ist ein Fall geheilt, einer nicht geheilt, die übrigen zehn haben rezidiviert. In 2 der Rezidivfälle begnügte man sich dann mit einer Auskratzung, und von diesen beiden Fällen ist der eine dann geheilt, während bei dem zweiten noch dreimal

Rezidive auftraten und erst nach der dritten Resektion Heilung erzielt wurde. In 8 Fällen ist als zweiter Eingriff eine Resektion vorgenommen worden, die in 5 Fällen den gewünschten Erfolg hatte, während die beiden übrigen wiederholt rezidierten und erst nach einer weiteren bzw. nach 5 Resektionen ausheilten. Bei der Nachuntersuchung zeigt es sich, dass der restliche Patient immer noch nicht geheilt ist, sondern seit 1936 Fisteln hat; an 3 verschiedenen Stellen sind neue Fisteln aufgetreten, die bisweilen sezernieren, bisweilen für kürzere Zeit »heilen«. Von den übrigen sind indessen 7 geheilt mit Observationsperioden zwischen $\frac{1}{2}$ und 22 Jahren.

Auskratzung ist als erster Eingriff in 5 Fällen gemacht worden. Von diesen ist keiner geheilt, und zwar ist einer als nicht geheilt zu bezeichnen, während bei den übrigen 4 Rezidive auftraten. Nach erneuter Auskratzung heilten 3 der Rezidivfälle, während die Resektion im restlichen Falle ein neues Rezidiv zur Folge hatte, das nach einer weiteren Inzision und einer Resektion heilte. Bei der Nachuntersuchung leben 2 Patienten als geheilt (Observationszeit 24 bzw. 22 Jahre), die drei anderen sind tot.

In 44 Fällen ist als erster Eingriff eine *Resektion* gemacht worden. Von diesen sind 31—73 % — per primam oder nach einiger Zeit geheilt, während 10 als nicht geheilt rubriziert sind. Die Rezidive beschränken sich auf 3 Fälle — 7 % der primär resezierten —, und nach erneuter Resektion wurden zwei von diesen geheilt, während der dritte um so schwieriger war und noch weitere 2 Resektionen und 3 Inzisionen erforderte, ehe auch er geheilt wurde. Bei der Nachuntersuchung leben 24 Patienten gesund, während 20 — darunter sämtliche als »nicht geheilt« rubrizierten — tot sind.

Diese Zusammenstellung der operativen Ergebnisse liefert einen durchaus klaren Bescheid. Die bestätigt die Erfahrung, dass eine radikale Resektion die besten Früh- wie auch Spätergebnisse gewährleistet. Von den 17 Fällen, bei denen der primäre Eingriff keinen radikalen Charakter hatte, ist nur ein Fall — 6 % — im Anschluss an die Operation geheilt, während 70 % der Fälle mit sofortiger Rippenresektion primär heilten. Der Unterschied ist statistisch gesichert (Diff. 64 % \pm 9.0 %). Es zeigt sich auch die Bedeutung dessen, dass die Resektion gleich als erster Eingriff durchgeführt wird. Von den 9 Fällen, bei denen die Resektion der zweite Eingriff war, hatten 3 Fälle Rezidive, d. h. eben so viele wie in der ganzen Gruppe der 44 primären Resektionen. Man könn-

te einwenden, dass die Zusammenstellung einen allzu günstigen Eindruck erwecke, da die als »nicht geheilt« bezeichneten Fälle ebensogut als Frührezidive angesprochen werden könnten, was die Rezidivfrequenz auf etwa 30 % der Resektionen erhöhen würde. Dies wäre m.E. aber falsch, da die etwaigen Misserfolge in diesen Fällen nicht der Operationsmethode, sondern anderen Umständen zur Last gelegt werden müssen. Es bleibt die Tatsache bestehen, dass nur 3 der primär resezierten Patienten sich einem zweiten Eingriff haben unterziehen müssen.

Von den Faktoren, die das Operationsergebnis beeinflussen, haben wir die — nach allgemeiner Erfahrung — wichtigsten bereits genannt: das Vorkommen einer anderen manifesten Tb. und das, was man allgemein die immunbiologische Lage nennen könnte, die wenigstens zum Teil von Alter des örtlichen Prozesses abhängig ist. Die Frequenzzahlen bei einer Untersuchung, die diese Faktoren berücksichtigt, sind indessen recht klein, weshalb eindeutige Antworten kaum zu erwarten sind. In der Gruppe »Primäreingriff Inzision« haben 5 der Fälle andere Tb., 7 dagegen nicht. Von den 10 Rezidiven entfallen 4 auf die erstere und 6 auf die letztere Gruppe — es besteht also kein Unterschied. In der Gruppe »primäre Auskratzung« hatte keiner der 5 Fälle eine andere klinische Tb. Interessanter ist die grosse Gruppe der »primären Resektionen«. Hier nehmen sich die Zahlen folgendermassen aus:

	Anzahl der Fälle	Geheilt	Nicht geheilt	Rezidiv
Ohne manifeste Tb.	27	22	5	—
Mit manifeste Tb.	17	9	5	3

Der Prozentsatz der Geheilten ist also in der ersten Gruppe 81 %, in der zweiten nur 53 %; ein statistisch sicherer Unterschied liegt nicht vor (Diff. 28 % \pm 14.2 %). Auffällig ist aber, dass sämtliche Rezidive Patienten mit anderer klinischer Tb. betrafen, und m.E. stützen auch die Zahlen dieses kleinen Materials die allgemeine Erfahrung, dass multiple Tb.-Lokalisationen die Heilung bei Radikaleingriffen ungünstig beeinflussen. Es muss in diesem Zusammenhang erwähnt werden, dass die drei Patienten mit Rezidiven in dieser Gruppe 52 bzw. 17 und 23 Jahre alt waren, da die Erfahrung sonst für ein grösseres Risiko ausbleibender Heilung in höherem Alter spricht.

Betrachtet man die Operationsergebnisse im Verhältnis zur Länge der Anamnese, so findet man — wie nach der bisherigen

Untersuchung zu erwarten war — keine irgendwie erkennbare Beziehung. In der Gruppe der Resektionen — die für eine diesbezügliche Beurteilung genügend gross ist — ist die prozentuale Verteilung der Fälle auf die einzelnen Gruppen mit verschiedener Anamnesenlänge dieselbe wie im Gesamtmaterial.

Ein dritter Faktor, der Interesse verdient, lässt sich an dem vorliegenden Material wegen der zu kleinen Zahlen nicht in gewünschter Weise beleuchten, nämlich die Frage, inwieweit das Bekanntsein der topischen Diagnose die Operationsergebnisse beeinflusst hat. Hier kann nur erwähnt werden, dass bei 2 der 3 Rezidive in der Resektionsgruppe eine exakte röntgenologische Herddiagnose vorgelegen hat, was, mit den übrigen Behandlungsergebnissen verglichen, die relativ geringe Bedeutung des fraglichen Faktors für den Behandlungserfolg andeutet.

Die sozial höchst wesentliche Frage nach der Dauer der Behandlungszeit lässt sich an Hand unseres Materials nicht zufriedenstellend beantworten. Die vorliegenden Angaben sind zu unvollständig, die Krankenanstalten haben zu sehr gewechselt, die poliklinischen Aufzeichnungen — soweit sie erfassbar waren — sind zu knapp. Allgemein kann man sagen, dass sich bei den primär geheilten Resektionsfällen die Behandlungsdauer in der Regel auf 2—3 Wochen beschränkte, wenn auch Fälle mit längerer Behandlungszeit — bis zu 10 Mon. Suppuration vor der Heilung sind registriert — nicht selten vorkommen. Andererseits hat sich der Prozess in den »missglückten Fällen« vielleicht über ein Jahrzehnt und darüber hinaus erstreckt. An dem vorliegenden Material zeigt sich eindrucksvoll der vom humanitären und sozialen Gesichtspunkt aus wesentliche Unterschied zwischen diesen Kategorien, wenn auch das Endergebnis der Behandlung schliesslich dasselbe war.

Die klinische Analyse und die Nachuntersuchung haben also in unserer Materialzusammenstellung eindeutig die Überlegenheit der Behandlungserfolge mit primärer Resektion bei Rtb. dargetan. Zugleich kann man jedoch die Bedeutung einer Rücksichtnahme auf die Reaktionslage des Organismus hinsichtlich der tuberkulösen Infektion nachdrücklich unterstreichen.

Zusammenfassung.

Der Verfasser gibt eine klinische Analyse und berichtet über die Nachuntersuchung von 75 Fällen von Rippentb., die in den

Jahren 1919—38 in der Chirurgischen und der Orthopädischen Klinik zu Lund behandelt worden sind. Die Fälle gliedern sich in zwei Gruppen: 1) Die mit einer anderen aktuellen oder überstandenen klinischen Tb. und 2) die Fälle, bei denen die Rippentb. die einzige klinische Manifestation ist. Von den 31 Fällen der ersten Gruppe sind bei der Nachuntersuchung 55 % tot, davon 45 % an Tb. verstorben, während in der zweiten Gruppe mit 44 Fällen die Sterblichkeitsziffer 40 % ist, mit nur 16 % Todesfällen durch Tb. Die Behandlung war in 12 Fällen nicht chirurgisch doch haben nur 4 von diesen eine konservative Behandlung im eigentlichen Sinne erhalten, von diesen letzteren waren 3 bei der Entlassung und bei der Nachuntersuchung geheilt. Inzision als erster Eingriff in 12 Fällen vorgenommen — von diesen 1 Fall geheilt, 1 Fall nicht geheilt, 10 Fälle mit Rezidiven. Eine Auskratzung des Herdes als erster Eingriff wurde in 5 Fällen gemacht: 1 nicht geheilt, 4 Rezidive. Primäre Resektion in 44 Fällen: 31 geheilt, 10 nicht geheilt, 3 Rezidive. Bei den Fällen mit Rezidiven ist als zweiter Eingriff in 5 Fällen eine Auskratzung gemacht worden: 4 geheilt, in dem fünften Fall erneutes Rezidiv, das nach weiteren 2 Resektionen und 1 Exstirpation heilte. In einem Fall wurde als zweiter Eingriff eine Inzision gemacht; dieser Fall rezidierte abermals, heilte aber nach 2 neuen Resektionen und 2 Inzisionen. In 11 Rezidivfällen wurde erneut rezesiert, von diesen Fällen heilten 8, während 3 abermals rezidierten. Bei der Nachuntersuchung waren 38 der 39 Überlebenden geheilt, während ein Patient seit 1936 sezernierende Fisteln hatte. Die Ergebnisse bestätigen die Überlegenheit einer primären Resektion als Behandlungsmethode bei Rippentb. Zu unterstreichen ist jedoch die Bedeutung einer Rücksichtnahme auf die Reaktionslage der Patienten im Verhältnis zur Krankheit und zur Allgemeinbehandlung.

Summary.

The author makes a clinical analysis and gives the results of a post examination of 75 cases of tuberculosis of the ribs which were treated at the Surgical and Orthopedic Clinics in Lund during 1919—1938. The cases can be classified into two groups: 1) those with an actual or healed clinical tuberculosis in other parts of the body and 2) those cases where tuberculosis of the ribs is the only clinical manifestation. Of the 31 cases in the first group the post examination showed that 55 % were dead, of which 45 %

died from tuberculosis, whilst in the second group the death rate among the 44 cases was 40 % of which only 16 % were from tuberculosis. In 12 cases the treatment was non-surgical although only 4 of these received conservative treatment in the real meaning of the word and of these 3 were cured when they were discharged from hospital and when post examined. Incision was performed as a first step in twelve cases — of these one case was cured, one was not cured and ten had a relapse. Scraping out of the nest was performed in five cases as a first step: one of them was not cured and four had a relapse. Primary resection was carried out in 44 cases: 31 were cured, ten were not cured and three had relapses. Five of the relapse cases were subjected to a scraping as a secondary measure of which 4 were cured whilst the fifth case had another relapse which healed after a further two resections and one extirpation. In one case an incision was made as a secondary step but this case had another relapse but finally cured after a further two resections and two incisions. In 11 cases of relapse resections were again performed and of these, eight recovered whilst three relapsed again. At a post examination 38 of the 39 cases still living were cured whilst one patient has had secerning fistulas. The results confirm the superiority of primary resection as a method of treatment in tuberculosis of the ribs. Nevertheless the importance of the patient's manner of reaction in relation to the illness and the general treatment is emphasized.

Résumé.

L'auteur analyse 75 cas de tuberculose costale traités dans les cliniques chirurgicale et orthopédique de l'Université de Lund entre 1919—1938 et expose le résultat d'un examen de contrôle. On peut diviser les cas en deux groupes: 1) ceux affectés d'une autre localisation tuberculeuse active ou guérie et 2) ceux où la tuberculose costale est la seule localisation. Dans les 31 cas du premier groupe, l'examen de contrôle constata 55 % de morts, dont 45 % de tuberculose; dans le second groupe (44 cas), 40 % de morts dont 16 % de tuberculose. Dans 12 cas, le traitement n'a pas été chirurgical; mais dans 4 seulement il a été conservateur dans le vrai sens du mot et de ces 4 cas, 3 étaient guéris au licenciement et lors de l'examen de contrôle. L'incision, comme première intervention, a été pratiquée dans 12 cas dont 1 a guéri, 1 n'a pas guéri et 10 ont récidivé. Dans les cas de récidence, on a procédé au

curetage dans 5 cas: 4 guéris, nouvelle récurrence chez le 5^e, lequel a guéri après deux résections et une extirpation ultérieures. Dans un autre cas, on a pratiqué une incision comme deuxième intervention: nouvelle récurrence mais guérison définitive après deux résections et deux incisions ultérieures. Dans 11 cas de récurrence, on a pratiqué une nouvelle résection: 8 cas guéris, 3 récurrences. Lors de l'examen de contrôle, 38 des 39 survivants étaient guéris, tandis qu'un malade présentait des fistules actives depuis 1936. Les résultats ont confirmé la supériorité de la résection primaire comme méthode de traitement de la tuberculose costale. Mais il faut insister sur l'importance de la réaction générale du malade à la maladie et au traitement général.

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and the Histological Institution of the University of Upsala
(Chief: Prof. M. Wrete).

Histological Investigation of the Resected Sympathetic Ganglia in Two Operated Cases of Thromboangiitis Obliterans, with Observations on a Number of Vascular Reactions.

By

TORD SKOOG,

med. lic.

Clinical Observations.

There may seem little point in communicating only two cases of thromboangiitis obliterans (Morbus von Winiwarter-Buerger) treated with lumbar sympathectomy, particularly when the period of observation is too short to testify with certainty to the operative effect. The cases are interesting for two reasons, however; one is their lack of agreement with SUNDER-PLOSSMANN'S very recent statement that this disease presents considerable changes in the resected vegetative ganglia, the other the observations concerning the consensual vascular reaction in these cases.

Summarized extracts from the records:

Case I: E. S., 47-year-old forester. No hereditary data of interest. Venereal diseases denied. Hard smoker since the age of 15 years. — Treated in hospital for *duodenal ulcer* in 1932. Since this time has been annually troubled by ulcers, recurring periodically. — There have never been any signs of cardiac insufficiency or affection of the coronary vessels.

About 1933 there was swelling of the right ankle and back of the foot for a short time, with tender red patches appearing in the swollen region.

In 1941 the right big toe was frostbitten, which resulted in permanent reduction of sensibility in the tip. Since autumn 1942 the patient has had a *sensation of numbness* in the distal third of the right lower leg; after some months *pain* started in the right foot, above all in the big toe. He went to several doctors, and was treated among other things with arch supporters. *Intermittent claudication* set in at the same time

Skin-Temp.

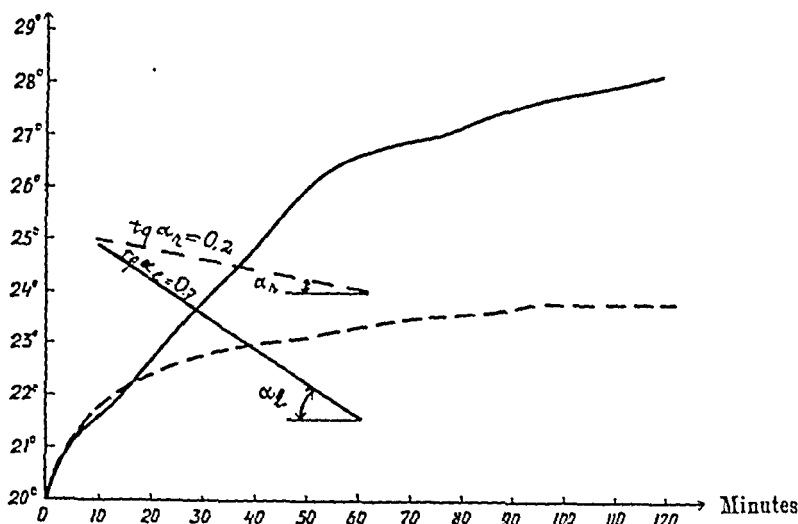


Fig. 1. Case I. Calorimetric determination of the heat emanating from the feet, when hands and lower arms are immersed in water at 44° C. The straight lines are in logarithmic relation to the curves.

— left foot --- right foot.

as the pain. The condition grew steadily worse, and the patient was admitted to the hospital on account of the severe pain in December 1942. At that time he could not walk for more than a few hundred metres without resting.

At this time the general condition was normal, with normal reflexes and normal heart findings. Wassermann reaction was negative.

Local condition: Right foot and lower leg were colder than the left; up towards the middle of the lower leg the skin was cyanotically reddened. Fissures but no ulcers occurred on one or two toe tips. *The pulse* in the popliteal artery was bilaterally similar on palpation; in the dorsalis pedis artery it was faint on both sides, particularly on the right. *Oscillometry* of the calves showed considerably poorer deflection on the right side (fig. 2). Calorimetric determination with measurement of the heat emanating from the left and the right foot to a definite amount of water according to Hultén's method (HULTÉN and KÄLLMARK, 1941) suggested a considerable reduction of the circulation in the right foot (fig. 1). This fig. also shows the "circulatory index" ($tg\alpha$) for the two legs determined by the method of the same author. When a vasodilatation was induced in this test by means of the *consensual vascular reaction* (hands and lower arms being immersed in water at 44° C), the pain in the right foot disappeared. Owing to technical accidents, *arteriography* did not yield a satisfactory result. Nevertheless, the whole of the narrow femoral artery was well filled out, and it showed even contours.

After recumbency and treatment with intermittent venous stasis, warm hand baths to produce consensual vasodilatation in the feet, and priscol, doryl and nicotinic acid amide, there was considerable

Units

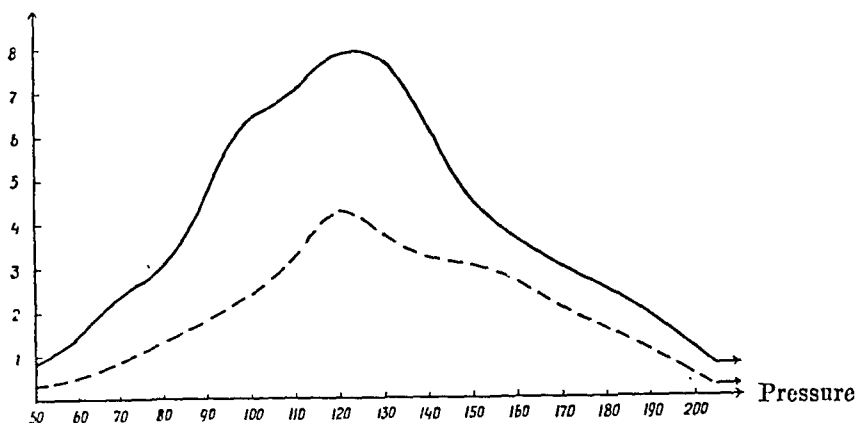


Fig. 2. Case I. Oscillogram *before* spinal anaesthesia.
— left calf --- right calf.

improvement in the course of 4 months, and the patient only occasionally felt pain in the right foot.

After he returned home, the pain soon recurred with increased intensity. It was sometimes so severe that he had to lie with the right lower leg hanging outside the edge of the bed. A slow-healing ulcer appeared on the right big toe. The pulse on the back of the right foot was no longer palpable. *Spinal anaesthesia* for diagnostic purposes at once gave the patient a pleasant feeling of warmth in the affected leg before the anaesthetic began to work. The pains disappeared and a plain increase in warmth was noticed. Nevertheless, the skin-temperature was still a few degrees lower on the right foot, indicating a certain occlusion of the vessels, as well as spasm. On the other hand, the oscillographic deflections were practically the same for both calves (figs. 2 and 3). The consensual vascular reaction was registered before and after the administration of spinal anaesthesia (figs. 4 and 5). An operation was plainly indicated May 19, 1944: Operation (Prof. HULTÉN). *Sympathectomia lumb. dx.* The lumbar part of the truncus sympathicus was removed on the right side from the height of the second lumbar vertebra to the fifth.

The consensual vascular reaction was measured postoperatively (fig. 6). The patient had no pain in the time from the operation to his discharge 3 weeks later. The ulcer on the big toe was almost healed, and the only trouble from the right leg was a slight sense of overfullness when walking and standing.

Case II: O. H., 46-year-old manual labourer. No unusual hereditary data. Venereal diseases denied. Heavy *smoker*. During the last few years he had even arisen at night to smoke. Also he had drunk too much alcohol. — As a child he had diphtheria and "glands of the neck".

In 1925 stomach resection was performed for *gastric ulcer*. He had no trouble subsequently until 1936, when he had acute abdominal pains and diarrhoea and was treated under the diagnosis of enteroco-

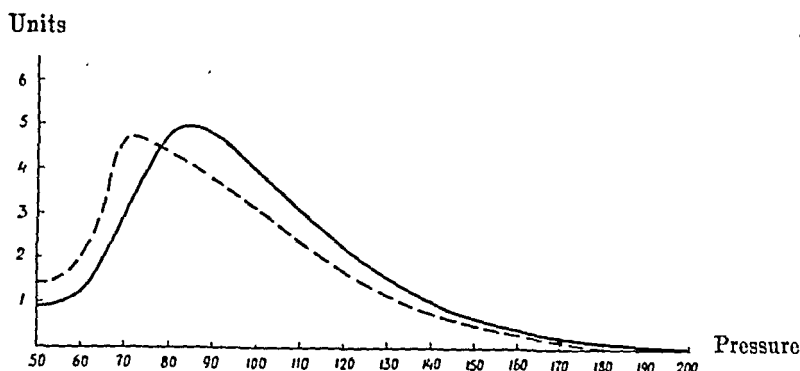


Fig. 3. Case I. Oscillogram during spinal anaesthesia.

— left calf --- right calf.

litis chronica. Achlorhydria. During the last few years he had intestinal disorders, which might sometimes set in acutely with abdominal pains and diarrhoea.

He has suffered since the age of 25 years from occasional severe headaches, sometimes with vertigo.

There was sometimes aching and feeling of numbness in the right arm above the elbow lasting for an hour or so, and from no apparent cause. — He had no heart trouble.

Since 1933 there had been increasing weakness in the legs with intermittent claudication, aching in both calves, especially in the left one. When cold, the feet felt numb.

On Dec. 2, 1943 the patient was admitted to the hospital in the diagnosis Embolia art. fibul. sin. Immediately before admission he had contracted sudden, violent pains in the left lower leg.

General condition normal. Reflexes and state of heart normal.

Local condition: The left foot was colder than the right, with white, somewhat cyanotic colour. The pulse on the left side was not palpable distal to the middle of the thigh. Sensibility in the foot was reduced. Heparin and A. P. treatment were started immediately and the prothrombinindex was kept at about 20 for a week.

After about a week the pains were less, the colour had improved and the feeling had begun to return. The consensual vascular reaction could not be obtained from the left foot, and the test yielded only a slight rise in the skin temperature of the right foot. Oscillometry showed no deflections on the left calf, and 2.2 units deflection on the right calf. Measurement of the thigh gave normal deflections on the right side, 7 units, but only 2.5 units on the left.

About a month's conservative treatment with rest, heat, spasmolytica and priscol, was followed by a considerable improvement of the circulation, but there were periods of severe aching in the left leg. A small ulcer developed on the third toe of the left leg. The condition was on the whole unchanged during the next few months. However, the ulcer turned into a slowly developing gangrene. Oscillometry and vascular reactions showed no improvement in the circulation. The

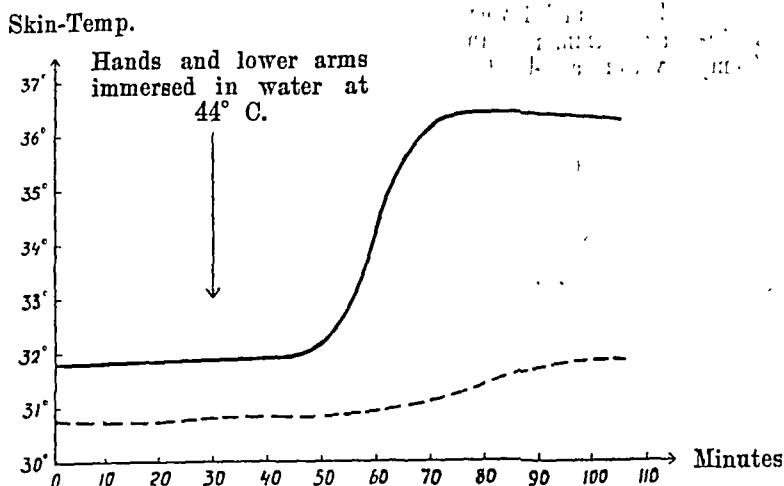


Fig. 4. Case I. Diagrams showing the consensual vascular reaction *before* spinal anaesthesia. (Rise in the surface-temperature of the feet by heating the upper extremities.)

— left foot --- right foot.

patient was completely disabled by his pain, and required a fair amount of narcotics. It was therefore decided to operate, although diagnostic spinal anaesthesia did not reveal objective improvement of the circulation. June 14, 1944: Operation (Prof. HULTÉN): *Sympathectomia lumb. sin.* The truncus sympathicus was removed on the left side from the first to the last lumbar ganglia. After the operation, the aching in the leg gave place to an agreeable feeling of warmth. The temperature of the left foot was 1.9°C higher than that of the right.

Three months later the patient still had no pain in the leg, and the gangrene on the 3rd toe healed, although slowly — there was osteoarthritis — and the aching in this toe remained and was sometimes severe. The skin felt warm over the whole leg. When it was held up, with the patient supine, it did not whiten, as it had done previously, nor did it ache. When the patient was sitting, with his legs dangling, the feet did not turn cyanotic, but retained their normal colour. The consensual vascular reaction showed no definite improvement.

After amputation of the 3rd toe on the left leg, the ulcer healed properly, and the patient has subsequently had no pains.

Thus, in these two cases of thromboangiitis obliterans, lengthy conservative treatment led to improvement of the circulation, but could not free the patients from their severe pains. In the latter case, moreover, gangrene threatened to spread. In these circumstances, sympathectomy seemed to be the final possible therapeutic step.

In the first case, the results of the operation must be regarded as very satisfactory. BROWN and ADSON 1925 report that a post-

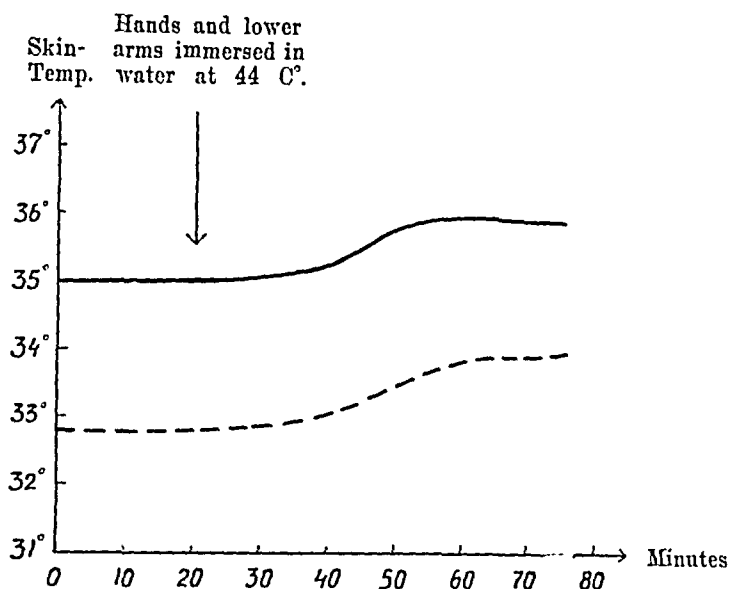


Fig. 5. Case I. Diagrams showing the consensual vascular reaction during spinal anaesthesia.

— left foot --- right foot.

operative rise in temperature of 6° to 8° C only appears in the most favourable cases. In the clinic of M. HÄMÄLÄINEN I have observed a rise in temperature of 10° C in a patient, who had a very low skin temperature before the operation. Case I reported here yielded a difference in temperature between the feet of 6° C on one occasion. This points to strong vasodilatation on the operated side compared with that obtained on the "healthy leg" when performing the consensual vascular reaction (fig. 6). It is to be noted that the skin temperature had earlier always been one or a few degrees lower on the right side.

Not much benefit could be expected from the operation with the serious circulatory disturbance in the second case, indicating a severe organic vascular lesion. Nevertheless, the effect was relatively good. FILATOV 1930 has described 2 cases which seem clinically comparable with this one. The results of operation on these were reported to be wholly negative.

Particular interest attaches to the consensual vascular reaction in Case I. As appears from fig. 4, it could not be produced in the normal way on the right side. Spinal anaesthesia, fig. 5, on the other hand, was followed by an equal increase of heat in both feet, even though the temperature at all times was somewhat lower on the right side. This shows that the consensual

Skin-Temp. °C.

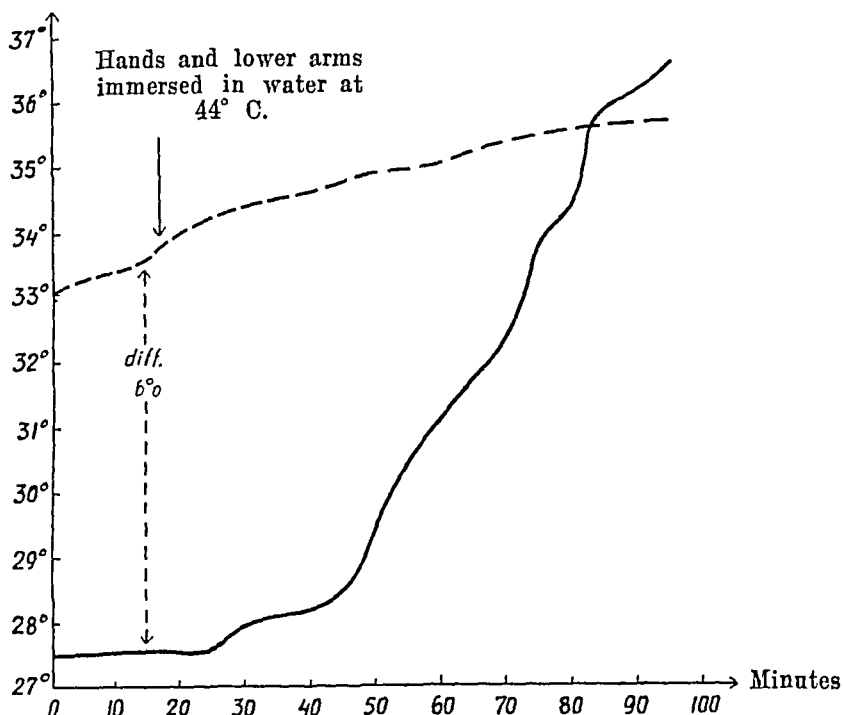


Fig. 6. Case I. Diagrams showing the consensual vascular reaction after lumbar sympathectomy on the right side.

— left foot --- right foot (sympathetomized side).

vascular reaction can be set up even after the central centres for vascular innervation have been shut off — a further proof that the reaction is caused by a factor transported via the blood vessels. The experiment also shows that this factor affects the vessels peripherally. It is also significant that the vasodilatory effect in the test is apparently unable to overcome a strong vascular spasm, as in this case (see fig. 4), but does produce only a slight and tardy reaction.

When the vasoconstrictory nerves have been cut off, the consensual vascular reaction appears more rapidly and more distinctly. Thus, spinal anaesthesia has not caused a maximal dilatation of the blood vessels in the feet.

A noteworthy point is that both the patients described here suffered from gastric ulcers. This may be pure coincidence, as I have not seen in the literature any data as to the concurrence of gastric ulcers in this disease. The observations may be of interest in connection with theories postulating vascular disturbances as a source of gastric ulcers.

During recent years English and American authors in particular (McDOWALL 1938, WHITE and SMITHWICK, 1942) have published excellent surveys of the patho-physiology of the circulatory disturbances, covering the rapid advances in their operative treatment during the last few decades, and the new improved diagnostic methods which paved the way. The principle of these methods is the temporary elimination, in some way or other, of the action of the sympathicus on the blood vessels (BROWN's fever test, 1926, sympathicus blockade according to WHITE, 1930), spinal anaesthesia according to MORTON and SCOTT, 1930. This provided an idea of how far the circulatory disturbance is contingent on an organic or a spastic vascular constriction — a piece of information which is necessary to clarify the indications for operation. In Sweden, this subject has been comprehensively and concisely treated by BAUER, 1940, I shall therefore not go into the diagnostics in more detail.

One point deserves mention, however. Literature contains numerous observations of the skin-temperature and its physiological relation to the vegetative nervous system. As a rule, the temperature and colour of the skin is considered to give a rough gauge of the circulation in an extremity. Some investigations, however, show that this view needs modification, especially as applied to the assessment of the effect obtained from sympathectomy. The blood vessels are subjected to complicated influences of nervous and humoral nature, and a central operation in the vascular innervation still leaves free play to many factors affecting the vessels. THEISS, 1933, emphasizes that the peripheral capillary reflexes are independent of central control; KUNZ, also, considers that the inconstant skin temperature after sympathectomy points to independent peripheral vasomotoric reflexes.

OUGHTERSON, ASHLEY, HARVEY and RICHTER, 1932, showed that the skin temperature in experimental animals was the same on both sides 4—6 weeks after unilateral sympathetic ganglionectomy. McCULLAGH, McFADEN and MILROY, 1930, point out that the recovery of the cutaneous vascular reaction after sympathicus operations is slower and less complete in man than in animals. However, the fact that cutaneous arterioles resume their earlier state of contraction after immediate postoperative dilatation need not mean that the larger vessels behave in the same way; see the experiment described below. Conclusions from experiments

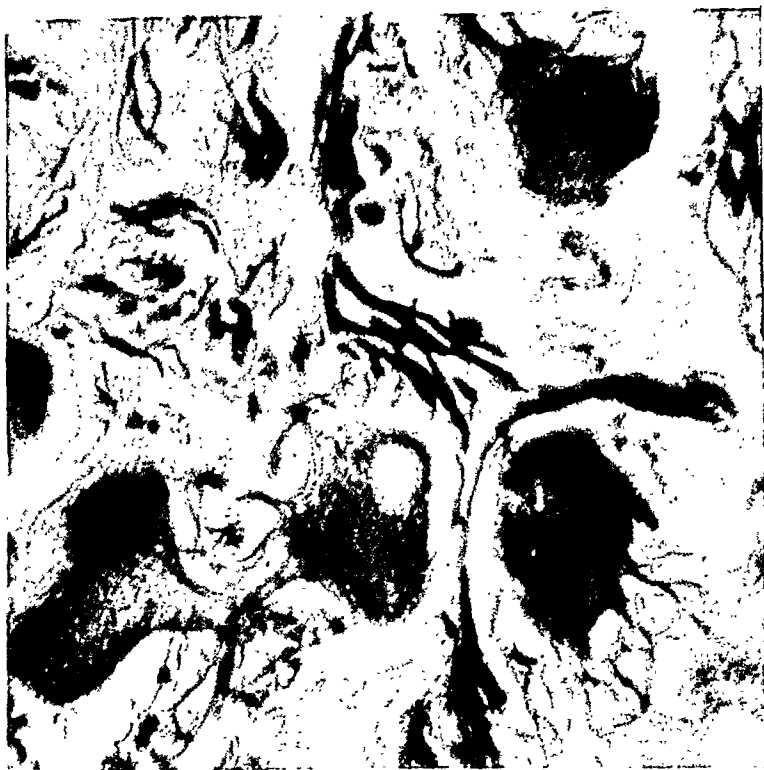


Fig. 7. Silver-impregnated lumbar sympathetic ganglia in Case II.
Microphotograph. — $\times 620$.

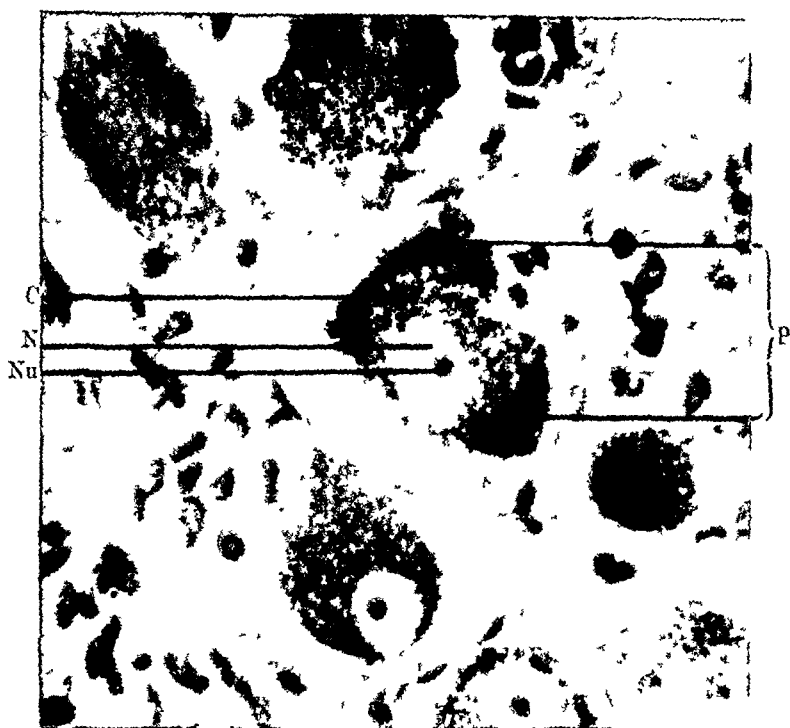


Fig 8. Lumbar sympathetic ganglia in Case II. Stained acc to Nissl
Microphotograph. — $\times 620$.

P — pigment N — nucleus. Nu — nucleolus, C — cytoplasm.

of this type on animals must always be applied with certain reservation to human subjects, whose circulatory conditions in hands and feet are so different.

Histological Observations.

As was mentioned, SUNDER-PLASSMANN, 1943, in a monograph on the vascular diseases and their treatment, and later in a work together with RICHTER in 1943, states with respect to thromboangiitis obliterans: "nearly all ganglion cells (this refers to resected truncus sympathicus ganglia) show intense pathological changes, of such a degree that they can be photographed, and they are so distinct that they do not need to be described", though they have not been recognized earlier. This statement is made with reference to a picture of a silver-impregnated specimen from a truncus sympathicus ganglion, where all internal cellular structures appear obliterated. On the other hand, the authors give a detailed description of the changes in the capsule cells of the ganglia cells. They expand the theory of STÖHR Jr., 1941 that these capsule cells constitute a "Nebenzellplasmodium". STÖHR Jr. considers the capsule cells with their chromaffin and chromophobe cellular types, possibly immature ganglia cells also, to form a cellular mass without characteristic morphological qualities. Further they state that there is a most intimate morphological and functional connection between this plasmodium and the ganglia cells. Neuroplastic powers are unreservedly assigned to the cells in the plasmodium, though no proof is adduced for this.

After silver impregnation according to Bielschowsky in Boeke's modification SUNDER-PLASSMANN and RICHTER, 1943, have found this plasmodium from executed people to show a subtile, nervous, interplasmatic network, which STÖHR Jr. described earlier as terminal reticulum. The pathological changes are reported to appear in these as yet not generally accepted structures. According to SUNDER-PLASSMANN, CAJAL's interstitial ganglia cells together with the neurogenic capsule cells form a neuro-hormonal cell system. Reproductions of this include the reticulum, which is reported to be of a nervous nature. CAJAL, 1935, HERZOG and GÜNTHER, 1938, with others, deny the existence of a terminal reticulum.

On the other hand, NISSL granules, which normally appear in the capsule cells only by way of exception (STÖHR Jr., 1941),

are reported as appearing not infrequently here in thromboangitis obliterans, and are thought to be either the sequel of phagocytosis of ganglia cells — neuronophagia — or possibly a sign of regeneration.

The pathological changes in the sympathetic ganglia are summed up as comprehensive and far-reaching. The fact that they have not been described before is attributed to poor histotechnique, or to the "affected focus" not always having the same location in the sympathetic nervous system. The idea that the changes described are of unspecific nature is rejected as convenient negativism, and SUNDER-PLASSMANN forestalls all criticism with the words that no one has the right to pronounce on this question, who has not provided himself with the opportunities of seeing the described terminal reticulum by years spent studying technique and preparations.

Histological studies of the sympathetic ganglia in thromboangitis obliterans have been done only by a few investigators, and consist mainly of isolated observations. An exception to this is the material by CRAIG and KERNOHAN, 1933, comprising 97 ganglionectomized cases, which are compared with a normal material of 40 autopsy cases. These investigators found a surprisingly large percentage to show macroscopic inflammatory reaction with enlarged glands around the sympathetic ganglia. Histologically, however, no signs of acute or chronic inflammation were observed in the ganglia. Slight proliferation of the endothelial cells was seen in a number of arterioles, and beside this, oedema in the tissue was more frequent than normally. A number of ganglia cells showed vacuolar degeneration. The pigmentation of the ganglia cells was carefully studied, and in older patients were found to be present in up to 90 % of the cells. The pigmentation increased with age and was possibly somewhat more usual than in the normal material, but the relatively small number of cases allows no definite conclusion. Summing up, they state that no microscopic changes were observed that did not lie within normal limits.

The material to be reported here consists of the unilaterally resected lumbar truncus sympathicus from the cases described above. The specimens were fixed immediately after operation in neutral formalin. Some part was sectioned and stained according to NISSL. The rest was impregnated with silver according to AGDUHR's modification of BIELSCHOWSKY's method.

It is unnecessary to give a detailed description here of the clear normal pictures of vegetative ganglia which the specimens show. This appears to some extent even from microphotographs (figs. 7 and 8). Unquestionably degenerative changes could not be demonstrated in any cells. Pigment occurred more or less abundantly in most of the ganglia cells. According to BETHE and FLUCK, 1939, the amounts may normally vary considerably even within the same age group. The idea that the pigmentation of these cells is the expression of a degeneration has nowadays been abandoned by most investigators (STÖHR Jr., 1943, and others); when the cell picture is normal in other respects, the pigmentation is considered to be a variant in relation to the metabolism.

Despite sufficient enlargement, perfectly satisfactory optics, and excellent silver impregnation, it was not possible definitely to distinguish the terminal reticulum described by STÖHR. It is, in any case, difficult to observe cytoplasm with certainty in the capsule cells in silver staining. This is also emphasized by CRAIG and KERNOHAN, 1933, although they resorted to special stainings according to CAJAL and HORTEGA. Like nearly everyone else, these authors consider fissures around the ganglia cells to be due to shrinkage during fixation.

Discussion.

The pathogenesis in thromboangiitis obliterans is very obscure. Vague suggestions of an infectious process have never been accepted; on the other hand, it is often believed that the disease is an allergic manifestation set up by different toxic agents. SUNDER-PLOSSMANN, 1943, assumes furthermore the presence of a genetic factor.

Whatever the genesis ascribed to the disease, its actual process has previously been related to the blood vessels. With the favourable results of operations on the sympathetic nervous system, opinions are on record that the pathological changes in thromboangiitis obliterans are to be sought in the vegetative nervous system. However, when pathological changes could not be found in resected ganglia, investigators did not hesitate to assume their occurrence in central vegetative centres (CRAIG and KERNOHAN, 1933, SUNDER-PLOSSMANN and RICHTER, 1943).

The previously described observations of SUNDER-PLOSSMANN are therefore of fundamental importance, and demand further

investigations to confirm or refute them. His presentation allows the assumption that sympathicus operations provide a form of causal therapy and not merely a palliative method of influencing the perfusion of the collateral circulation. The prognosis differs materially depending on the attitude taken in this respect. SUNDER-PLASSMANN's enthusiasm for the operative treatment is not shared fully by other investigators.

Needless to say, the two cases communicated here do not decide the issue in these problems, but they are not in agreement with the new interpretations. The primary purpose of this report is, therefore, to point out this important discrepancy.

In this connection, it may be interesting to analyse to some extent the implications of SUNDER-PLASSMANN's statement compared with earlier discoveries and opinions. Normally, the vessels of the extremities have a certain spasm dependent on permanent sympathicus tonus. This has been shown by THEISS, 1933, for one, who in a series of experiments on 110 dogs ligated the femoral artery and then performed lumbar sympathectomy on the animals. He then observed an immediate increased circulation in the collateral arterial channels. According to HÄMÄ-LÄINEN, 1943, these experiments should not be regarded as conclusive, as he maintains that every main artery is to be considered as a vegetative nerve. Ligature of the artery sets up a state of irritation in the "nerve", with vascular spasm. He therefore states that sectioning of the vessel as well as ligature is necessary to eliminate the effect of the sympathicus. It is possible that this necessity explains the postoperative variability in the skin temperature in the denervated extremity of THEISS's experimental animals. However, using a "Thermostromuhr", HERRICK, ESSEX and BALDES, 1932, report that dogs exhibit an increased circulation in the femoral artery after only lumbar sympathectomy, and the phenomenon retained after nearly 3 years. This clearly shows that the vessels are normally under a sympathetic vasoconstrictive influence. It is also an everyday experience that plain signs of a vasodilatation appear in the lower extremities in lumbar anaesthesia.

In obliterating vascular diseases the main purpose of cutting off the sympathetic pathways is to remove the vascular contraction in the collateral channels. Thromboangiitis is usually attended by a considerable vasospasm particularly in the early stages (WHITE and SMITHWICK, 1942), probably released by re-

flexes. ROWNTREE and ADSON, 1929, find it possible that a sympathetic hyperactivity is related to chronic, nonspecific arteriitis. This vasoconstrictory reflex was first shown by LERICHE, in periarteriitis. When the vascular changes have gone too far, however, the walls of the vessels stiffen, and the spastic component of vascular constriction thereupon disappears. There is then nothing to be gained from sympathectomy. As mentioned above, it is possible to test by various means in how far a vasospasm is responsible for the impaired circulation, and therewith what may be gained from an operation. The explanation sketched here seems to me the most natural.

If, as SUNDER-PLOSSMANN states, *thromboangiitis obliterans* causes extensive pathological changes in the truncus sympathicus, this should gradually make for a lowered sympathicus function and therewith a decrease in the vasoconstriction in the corresponding vascular region — that is to say, just what is aimed at in sympathectomy. Needless to say, organic changes in the truncus may also cause irritation in the sympathetic nerves, but the irritation should in all circumstances cease as the process develops, since it leads to complete destruction of the ganglia cells. Thus FILATOV, 1930, has described a case of unilateral retroperitoneal tumour, where the skin temperature was reduced 3° in the leg of the same side. There were no other neurologic symptoms. As the tumour continued to grow, it completely destroyed the truncus. The irritation thus stopped and the temperature in the affected leg again rose. (The diagnosis was patho-anatomically verified.)

On the whole, ganglionectomy gives better results in arteriosclerosis, where there is no reason to assume localised pathological changes in the vegetative ganglia, than in thromboangiitis obliterans. This agrees well with the opinion stated above as to the patho-physiology of the vascular innervation, namely that sympathectomy eliminates the spasm caused by the disease in the vessels. Similarly, very good results are obtained from sympathectomy in injuries from chilling of the extremities (HÄMÄLÄINEN 1943, and others). All this makes SUNDER-PLOSSMANN's theory all the less acceptable.

One of the most crucial factors in this discussion is the post-operative prognosis of the disease.

Prognosis. In the cases of thromboangiitis obliterans described here, sympathectomy gave immediate relief to the patients

through an increase in the circulation which still persisted half a year after the operation. This is in agreement with general experience.

What are the long term results of the operations? The early enthusiasm which followed the introduction of the operative treatment has been somewhat dampened by later experience. As yet carefully reexamined cases are relatively scarce, I will review briefly the records submitted by authoritative authors in this field.

SMITHWICK and WHITE had in 1942 30 patients with 52 operated extremities. The results from 22 operations were very good, from 27 there was improvement and from 3 no improvement. To a great extent the effect depended on the stage of the disease at which the operation was performed. The result is much less successful when the pulse in the popliteal artery is no longer palpable. The importance of operating early is stressed by most authorities. In 1935, the above authors summed up their experiences by saying that it had been possible to reduce the number of major amputations by half, thanks to the sympathicus operations, and they consider the results to be better than in arteriosclerosis.

CRAIG and KERNOHAN, 1933, report that, under the most favourable conditions with conservative treatment, it is necessary to amputate in 25 % of the cases in thromboangiitis obliterans but in less than 5 % after sympathectomy. These investigators do not give the length of the observation period.

MAYO and ADSON, 1932, find an increased circulation in the sympathectomized extremity after an observation period of 5 years.

HÄMÄLÄINEN, 1943, in a lecture to "The Surgical Association of Sweden" (Svenska Kirurgiska Föreningen), made a preliminary report based on 68 lumbar sympathectomies performed on cases of thromboangiitis obliterans. He considers that the operation may yield an improvement lasting over several years, but there is always the risk of recurrence, and the results are less satisfactory than anticipated. In senile arteriosclerosis, on the other hand, he considers the operation to yield better results than expected. At that time he had operated on 71 patients with arteriosclerosis, 5 of them on both sides.

Thus, the results of sympathicus surgery in the obliterating vascular diseases are still contradictory and uncertain in some respects, even if the operative therapy appears to be the best

aid available at present. The vagaries of the treatment doubtless derive primarily from our ignorance of the pathogenesis of these diseases, but also from the fact that important sides of the physiology of the blood vessels and the finer anatomy of the vegetative nervous system — specially as regards the innervation of the vessels — are still unclarified.

Summary.

Two cases are described of thromboangiitis obliterans, with symptoms primarily from the leg, and the results of unilateral sympathectomy are submitted.

Observations as to the consensual vascular reaction after spinal anaesthesia are communicated.

Histological examination of the resected ganglia showed a morphology normal in all respects. SUNDER-PLOSSMANN's finding could not be verified, despite extremely successful staining of the ganglia tissue.

The significance of sympathectomy in the obliterating vascular diseases is discussed, especially with regard to SUNDER-PLOSSMANN's theories.

Zusammenfassung.

Es werden zwei Fälle von Thromboangiitis obliterans beschrieben, mit Symptomen vor allem seitens des einen Beines, und das Ergebnis einseitiger Sympathektomie mitgeteilt.

Über die konsensuelle Gefäßreaktion im Anschluss an Spinalanästhesie werden Beobachtungen mitgeteilt.

Histologische Untersuchung der resezierten Ganglien ergab in jeder Hinsicht normale Morphologie, und trotz ausgezeichneter Färbung des Gangliengewebes konnten die SUNDER-PLOSSMANN'schen Befunde nicht bestätigt werden.

Die Bedeutung der Sympathektomie bei obliterierenden Gefässerkrankungen wird, besonders im Hinblick auf die SUNDER-PLOSSMANN'schen Theorien, besprochen.

Résumé.

L'auteur décrit deux cas de thrombo-angéite oblitérante avec des symptômes prédominants à une jambe et le résultat d'une sympathectomie unilatérale.

Il communique les résultats d'observation de la réaction consensuelle des vaisseaux à la suite de rachi-anesthésie.

A l'examen histologique des ganglions extirpés on a constaté une morphologie normale à tous points de vue; on en peut confirmer les résultats de SUNDER-PLOSSMANN malgré une coloration très réussie du tissu ganglionnaire. L'auteur discute la portée de la sympathectomie dans les affections oblitérantes des vaisseaux, dans ses rapports particuliers avec les théories de SUNDER-PLOSSMANN.

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Two Operated Cases of Ankylosis Cubiti Congenita.

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Congenital ankylosis of the elbow is a very rare physical defect, but, especially when it occurs on both sides and in inconvenient positions, it may cause considerable disablement.

RAGNAR ROMANUS described one case in 1933, and at the same time he collected 23 others from the world literature.

The only cases observed in Norway were the 5 described by H. FROSTAD in 1940. Thus altogether there have been reported 29 cases, to which come the two that shall here be described.

The disease may be either unilateral or bilateral.

In several of the cases assembled by ROMANUS there were defects or abnormalities in the hand, fingers or fore-arm, such as concrecence of metacarpus, absence of metacarp and fingers, proximal or distal ulnar defects. Often there was a shortening of the fore-arm or upper arm. In ROMANUS's own case this latter defect was strongly pronounced, so that the affected arm was only half as long as the sound arm.

In all cases, except one, the radius is the chief bone in the fore-arm, and it merges with broad osseous connection direct into the humerus. The one exception has been described by CRAMER. In this case the humerus was ankylotically joined to the ulna, while the radius articulated freely with both. Thus pronation and supination could here freely take place. In a couple of cases the ulna was not present as a separate bone. In these cases the ulnar metacarp was also absent.

In five of the cases collected by ROMANUS the ankylosis was bilateral. But in several of the others there were congenital de-

fects in the other arm, and in a couple of cases this arm was entirely lacking. In all of FROSTAD's cases and in two of mine the affection was bilateral. The angle of flexion in the cases assembled by ROMANUS varied from 180 degrees to an acute angle. In four of FROSTAD's cases the flexion was rectangular on both sides, in the fifth it was 95 degrees for the left arm and 105 degrees for the right, and some of the patients had an awkward pronation position of the fore-arm.

In my two cases the position was acute-angled, from 65 to 85 degrees on slight pronation.

In spite of bilateral ankylosis the ability to work is surprisingly good, even in occupations demanding great exertion. This is seen in FROSTAD's cases. One patient had been a sailor and fisherman till he was 67 years old. One a farmer and fisherman, who was now 73. Both of them have done their work well all their lives. A youth of 19 did farm work in a satisfactory manner — and also worked as a paperhanger. At this latter work, however, he was slower than the others. A woman of 64 had been working as a farm-servant until she was 40 and did the milking, the house-work, as well as outdoor work on the farm, but she could not make bread, as she was not able to knead the dough. At the age of 40 she got inflammation in the right hand, with subsequent arthritis in the wrist and finger-joints. Since then she has stayed at home and kept house for an elder unmarried brother. A 12-year-old girl is going to school and is, among other things, clever at writing, drawing and sewing. (Angle of the right arm: 105 degrees, of the left: 95 degrees.)

There are mentioned a number of important daily tasks which these five patients cannot perform. For example, they cannot wash the face or neck, the upper part of the chest or the back. They cannot shave, wash their teeth or comb their hair. They cannot button their coat or the nipper part of the vest. They all had difficulties in eating. They had to bend the head forward in order to meet the spoon and fork.

Like most congenital deformities, this disorder is undoubtedly hereditary. SIWON in 1928 described the case of a 4-year-old girl with bilateral congenital ankylosis of the elbow. Her mother had had the same deformity and likewise her mother's paternal grandmother and the latter's sister. JOACHIMSTHAL in 1900 tells of an elderly man and his 30-year-old daughter, both of whom had bilateral ankylosis of the elbow.

In the five cases reported by FROSTAD the patients belonged to two families, one family with three elderly brothers (or sister) and one with two young persons (brother and sister). No relationship between the two families could be proved to exist, but they lived in the same district and associated with each other. My two patients were sisters, the only children of a young married couple. The *mother* states that her great-grandfather had three brothers (or sisters) who suffered from the same bilateral abnormality. They had no children. The great-grandfather himself was quite free from physical defects.

My three patients were also from Sunmöre, but from a different parish, and no relationship or connection can be proved to have existed between them and the two families mentioned by FROSTAD. Neither had they any acquaintance with each other. Very remarkable, however, is the great resemblance between all these cases from Sunmöre.

In the cases previously described in the literature the ages in 5 cases ranged from 10 days to 9 months. Of the others, one was a still-born child, prematurely born. One was 5 years old, one 7 years, three from 12 to 13 and one 15 years old. The rest were adults. My two patients were respectively a year and a half and six months old when they came for examination. In view of these facts one should suppose that the question of an early operation would have been considered, but no report of such an operation is to be found in the literature.

As regards the later operations I can agree with what FROSTAD writes: "The possibility of fashioning a new joint by operation has been discussed, but not tested. It must be assumed that an attempt to do so would be rather fruitless — chiefly because the muscles that should move the joint are completely atrophied." As regards children, however, I do not agree with this view. We have already noted the many great drawbacks to which these patients with bilateral ankylosis of the elbow-joint are subjected. The attainment of a flexion and extention movement of only 20 or 30 degrees — or even less — would be of great help. Even if only the power of rotation was attained, it would be no insignificant gain.

HANS FROSTAD examines the development of the joint in embryonic life and shows clearly how it is possible that the changes which lead to a congenital ankylosis of the elbow may appear already during the formation of the scleroblastema (the name

given to the first beginnings of the bones of the upper extremities at the close of the 4th week) and during the formation of the pre-cartilage and afterwards of the cartilage of the extremities in the 5th week of embryonic life.

In the pre-cartilaginous stage the scleroblastema forms a continuous whole. At the place where the joints are afterwards formed the development of the scleroblastema is retarded and no chondrofication takes place here. There is left a jellylike tissue which gradually atrophies, whereby there is produced a breach of continuity. From the surrounding tissues are formed the synovial membrane, the fibrous jointcapsule and the capsular ligaments. If now these necessary changes in the tissue of the scleroblastema fail to occur at the place corresponding to the site of the elbow, the chondrofication will continue without interruption from the humerus down to the radius and eventually to the ulna. A continuous bone will be formed.

On examining this explanation, however, there is reason to suppose that the rudiments of the muscles are present and that muscles are being formed — but that they afterwards atrophy owing to absence of functions. The one-joint muscles will disappear entirely (*Brachialis*). Some of the two-joint muscles, such as the biceps and the *caput longum tricipitis* stretch the elbow, has lapsed, they will always become greatly atrophied.

From what has been said above it may be concluded that, in order to attain any result from arthroplastic treatment of these patients, we must operate as soon as possible after birth, when there will be some chance of success.

In the schools of surgery and in the textbooks it is an established rule that arthroplastic treatment should be employed only for adults — partly because the epiphyses lie so close together; but chiefly, no doubt, for the reason that in case of children it was thought to be impossible to carry out with sufficient thoroughness and sufficiently early the active and passive movement therapy.

As appears from the following case, the painful stage is remarkably short, so that the child, when left to itself, begins to use the deformed arm in playing, provided it is prevented from using the other arm. It must be possible to utilize this circumstance more consistently than I have done — by keeping the child in hospital for a rather long time, during which it can be guided rationally. Epiphyseal lines are not present in the elbow region

in these cases, so that, even without operation, the arms are retarded in longitudinal growth (see, for instance, ROMANUS's case). If the joint after plastic treatment gradually begins to show signs of stiffening again, we must, of course, take care that its position is the best for as many as possible of the most necessary functions. (One arm in $75-80^\circ$, the other in $100-110^\circ$ flexion.)

The technique in the plastic treatment of the elbow-joint in these young children is, of course, far more difficult than in adults, while the course of the *n. ulnaris et radicalis* is more uncertain where the *epicondylus* are not prominent. I had a considerable feeling of uneasiness until I had isolated the *n. ulnaris*. The *ramus profundus* of the *n. radialis* also gives grounds for some anxiety during the chiselling through and the resection of the thick sclerotic radius.

Cases.

1. Jorun A., from Sykkylven in Sunmøre, came under treatment on $\frac{1}{6}$ 1941, when she was $1\frac{1}{2}$ years old. The mother's great-grandfather had three brothers (or sisters) who suffered from the same deformity. They were unmarried. Otherwise the disease was unknown in the family.

Both elbow-joints are ankylotic, the right in 70° and the left in 85° flexion — the forearm between pronation and supination — nearer to pronation. Wrist, hand and fingers normal, likewise the shoulder-joint. The upper arm seems a little short. The separate muscles of the forearm and upper arm cannot be distinguished on palpation, owing to the adiposity usual in children, but both the upper arm and the forearm are of normal thickness and configuration.

A roentgenogram which had been taken on $\frac{6}{6}$ 1941 (Fig. 1 a and b) shows uninterrupted transition of the humerus to the radius, without any suggestion of a joint. The corticalis on the anterior side of the humerus continues evenly over into the corticalis of the radius, without any sign of the capitulum, the thickest part being at the point of flexion. There are no epiphyseal lines in the lower humerus or upper radius. The radius is much stronger than the ulna and has a thicker corticalis. Otherwise the ulna is well developed and there is a space between the ulna and the humerus. The *epicondylus* are present. There is seen a shadow in the soft parts at the site of the biceps and a somewhat more distinct shadow of the forearm muscles.

She has a bilateral subluxation of the hip, most marked on the right side. (This healed spontaneously in the course of a couple of years.) A new roentgenogram of the elbow joints on $\frac{6}{6}$ 1941 shows increased growth, but otherwise the same conditions.

$\frac{13}{7}$ 1943 (two years later): Roentgenogram of the non-operated arm shows that the radius has increased considerably in thickness, also relatively, and is now of the same thickness as the humerus (Fig. 2).

The corticalis at the point of flexion has increased disproportionately in thickness and is here 8 mm thick. The space between humerus and ulna is unaltered.

On $^{10}/_{10}$ 1941 (the child being then $1\frac{1}{2}$ years old) an *arthroplastic* operation on the left arm was performed in ether narcosis. Posterior longitudinal incision. The tendon of the *triceps* was found to be thin and atrophied, likewise the visible part of the muscle. There was a firm cartilaginous connection without any gap, between ulna and humerus. The ulnar nerve and forearm muscles, *which were well developed*, were shoved forward, likewise the *radial muscles of the forearm*. Without detaching the periosteum and perichondrium, the cartilage connecting the humerus and ulna was loosened with the knife and a *facies semilunaris* was formed, with retention of the olecranon. Thereupon the hard sclerotic radius was cut through with a chisel at the point of transition the ulna, 1 cm being resected.

The resection surfaces were covered with a double flap of fascia taken from the thigh and fastened to the bone-edges by catgut sutures. After the operation the extension was 140° and the flexion 70° , with almost free pronation and supination (Fig. 3).

The child lay with her arm resting loosely on a pillow and by degrees she was allowed to move it as she herself wished. After 14 days the non-operated right arm was tied up, so that she was forced to use the other arm, which she did to an increasing extent. The movements were apparently painless.

She was discharged after one month, and the mobility was then a little less than at the time of the operation. The arm seemed mostly to fall backwards and forwards in flexion and extension. but no certainly active flexion and extension movements could be observed. The pronation and supination movements, however, were distinctly active. Abnormal lateral mobility was not noted in the movements mentioned.

She was already clever in using the arm and already now it was evident that she instinctively made use of the force of gravity in her manœuvres with the arm.

At that time, however, I regarded the result as very doubtful, until I got a letter from her mother on $^{12}/_{1}$ 1943, *i. e.*, a year and nine months later, in which she wrote: "The arm is a good deal better than the one which was not operated. She can bend it towards her more than she could in the position it was in before, and she can stretch it almost quite out. She also likes to use the left arm most, probably because it is more free. We are very grateful for what has been done, and would like to come to Oslo to have the other arm operated also." At the same time she says that she has now had her second child — a daughter with the same bilateral deformity as the sister, and she would like to have her operated too.

On $^{13}/_{7}$ 1943 the former patient came in order to have the right arm operated (and at the same time the six-months old sister who had the same deformity). The operated left arm now shows: Passive flexion to 75° and extension to 115° , *i. e.*, 20° less than when she was discharged. There is a suggestion of active flexion movements. When playing, she



Fig. 1 a. Left elbow.

Case 1.

A



Fig. 1 b. Right elbow.

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Fig. 2.



Fig. 3.

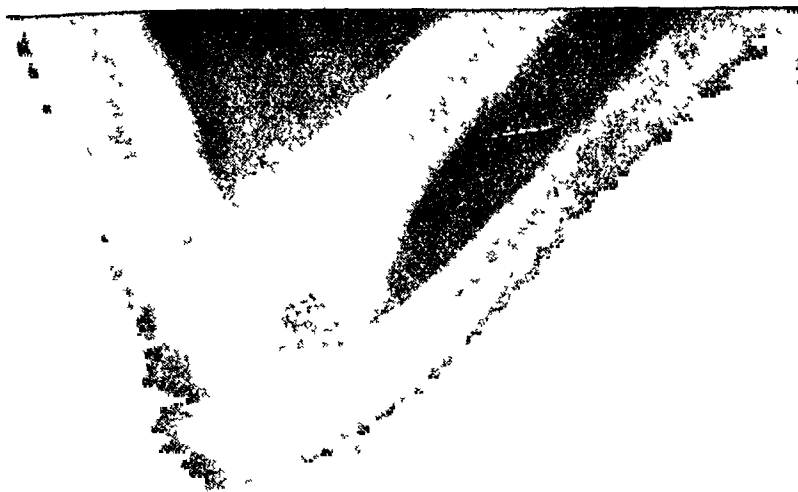


Fig. 4 a.



Fig. 4 b.



Fig. 4 c.

Case 1.

Two years after operations.

Fig. 4 a. Left elbow. Maximum flexed position. Fig. 4 b. Left elbow. Medium flexed position. Fig. 4 c. Left elbow. Maximum stretched position.



Fig. 5 a. Left elbow.



Fig. 5 b. Right elbow.

Case 2.

seems to utilize the power of passive movement. There is full pronation and supination, which can be performed actively. No lateral mobility.

The roentgenogram shows a space 2—5 mm broad between radius and humerus — varying according to the position of the arm. The humerus forms a hypomochlion for the ulna and protrudes about $1\frac{1}{2}$ cm behind the point of contact. No facies semilunaris is to be seen. The nearthrosis surfaces are slightly uneven, with small excrescences on the posterior side of the humerus. (See Fig. 4 a, b, c.)

The roentgenogram of the unoperated arm has been previously described (see Fig. 2).

2. Björg A. The above patient's 6-month-old sister.

Shows ankylosis in both elbow-joints. 65° angle in the left, 75° in the right elbow. The hands are normal and well-shaped, the arms possibly a little short in proportion to the length of the body. The musculature of the forearm and hand is good, so far as can be judged in a child. Otherwise no deformities.

X-ray examination shows a broad bony connection between humerus and radius and a thick corticalis going direct from the ulna over to the diaphysis of the radius. At the point of flexion the corticalis on the volar side has a thickness of 8 mm. Here there is also a broad bony connection between the ulna and the medial humerus. No epiphyseal lines in the region of the elbow-joint (see Fig. 5 a and b).

On $5/7$, 1943 an arthroplastic operation on the left elbow was performed in ether narcosis, in the same manner as in her sister's case. There was here encountered considerable difficulty getting through the thick hard corticalis. Of special interest was the observation that both the triceps tendon and the visible part of the muscle were here considerably better developed than in her sister, who was one year older at the time of operation.

The local medical officer reports on $15/6$ 1944:

Jorun A., now 4 years old. The left arm (the first arm operated $2\frac{1}{2}$ years ago) can be stretched 135° and bent to 90° (1 year ago 115° and 75°). The right arm (the last operated) is stiff. Björg, now 2 years old: No mobility of the joint.

In short, the result as regards the arm first operated was good for two years, and then the mobility began to decrease. As regards the other arm the result was bad, and likewise in the case of the younger child. It is possible, however, that consistent and long-continued after-treatment would have led to better results. Here the children were mostly left to themselves, owing to preconceived pessimism. It is also possible that improved technique might have yielded a better result.

Summary.

The author describes two cases of bilateral congenital ankylosis of the elbow in two sisters who were brought to him for examina-

tion. One of them was $1\frac{1}{2}$ years and the other 6 months old. They were otherwise free from deformities, as were also their parents, whose only children they were. The mother's great-grandfather had three brothers who presented the same anomaly. In Norway there have now been described altogether 7 cases, including these two. All of them are from Sunmøre County and they bear a remarkable resemblance to each other, but no relationship between the families can be found to exist.

In case of the elder child the author operated on both elbows, on one of them when the child was $1\frac{1}{2}$ years and on the other when she was 3 years old. The operation on the other child was performed at the age of 6 months. The joint first treated has shown good results for $2\frac{1}{2}$ years, but the mobility has since decreased. The two joints last operated on have by degrees become quite stiff.

The author refers to FROSTAD's account of the development of the joint — and of the manner in which this anomaly may be supposed to arise — and he regards it as probable that the muscular rudiments are to be found in the embryonic stage of life and that the muscles are still present at birth, but then comparatively soon become atrophied.

The operations also showed that the musculature of the elbow was present, although there was considerable atrophy (or absence of development?) both of the muscles and of the triceps tendon. It is worthy of note that they were best developed in the earliest operated arm. The operation must therefore be performed at the earliest possible age, if any result is to be expected. And the author believes that the operation ought to be attempted, as improved technique and more careful after-treatment would probably yield better results than those here reported.

The growth cannot be impaired by the operation, as epiphyseal lines are not present in these cases. If stiffening of the joint should again take place, then care must in every case be taken to secure the most convenient position possible — and in most cases the power of rotation is probably preserved.

Zusammenfassung.

Verf. beschreibt zwei Fälle von bilateraler kongenitaler Anchylose des Ellbogens bei zwei Schwestern, die ihm zur Untersuchung gebracht wurden. Die eine war $1\frac{1}{2}$ Jahre, die andere 6 Monate alt. Im

übrigen waren sie frei von Missbildungen, wie auch ihre Eltern, deren einzige Kinder sie waren. Der Urgrossvater der Mutter hatte drei Brüder, die die gleiche Anomalie aufweisen. In Norwegen sind bisher im ganzen 7 Fälle beschrieben worden, diese 2 einberechnet. Sämtliche stammen aus der Provinz Sunmøre und zeigen eine bemerkenswerte Ähnlichkeit miteinander, doch kann keine Verwandtschaft der Familien miteinander nachgewiesen werden.

Bei dem älteren Kinde operierte Verf. beide Ellbogen, den einen, als das Kind $1\frac{1}{2}$ Jahre alt war, und den anderen, als sie 3 Jahre war. Bei dem andren Kinde wurde die Operation im Alter von 6 Monaten vorgenommen. Das zuerst behandelte Gelenk zeigte $2\frac{1}{2}$ Jahre lang ein gutes Ergebnis, doch hat die Beweglichkeit später abgenommen. Die zwei zuletzt operierten Gelenke sind nach und nach völlig steif geworden.

Verf. referiert FROSTAD's Bericht über die Entwicklung des Gelenks, und über die Art, in der vermutlich diese Anomalie zur Entwicklung kommt, und hält es für wahrscheinlich, dass die Muskelanlagen im Embryonalstadium zu finden sind, und dass die Muskeln noch bei der Geburt vorliegen, dann aber verhältnismässig schnell atrophisch werden.

Die Operationen zeigten gleichfalls, dass die Muskulatur des Ellbogens vorhanden war, obwohl bedeutende Atrophie (oder Mangelhafte Entwicklung?) sowohl der Muskeln als auch der Trizepssehne vorlag. Bemerkenswert ist, dass sie an dem zuerst operierten Arme am besten entwickelt waren. Die Operation muss deshalb in möglichst frühem Alter vorgenommen werden, wenn man einen Erfolg erzielen will. Verf. ist der Ansicht, dass die Operation versucht werden sollte, da verbesserte Technik und sorgfältigere Nachbehandlung wahrscheinlich bessere Erfolge geben werden, als die hier wiedergegebenen.

Das Wachstum kann durch die Operation nicht geschädigt werden, da in diesen Fällen keine Epiphysenlinien vorliegen. Falls ein Wiedersteifwerden des Gelenkes eintritt, ist in jedem einzelnen Falle auf Erzielung einer möglichst bequemen Stellung zu achten — und in der Mehrzahl der Fälle wird wahrscheinlich die Rotationsfähigkeit erhalten bleiben.

Résumé.

L'auteur décrit deux cas d'ankylose congénitale bilatérale du coude chez deux soeurs qu'on lui avait amenées aux fins d'examen. L'une avait un an et demi, l'autre six mois. Autrement elles

étaient indemnes de malformations, comme leurs parents aussi, dont elles étaient les seuls enfants. L'arrière-grand-père de la mère avait eu trois frères présentant la même anomalie. En Norvège on a jusqu'ici décrit sept de ces cas en tout, en y comprenant ces deux-ci. Tous proviennent du Comté de Sunmøre et offrent une ressemblance remarquable, mais on n'a pas pu établir l'existence d'une relation de parenté entre les familles.

Dans le cas de l'ainée des fillettes l'auteur opéra les deux coudes: l'un quand elle avait 1 1/2 an, et l'autre à l'âge de 3 ans. L'opération de la seconde enfant fut pratiquée à 6 mois. L'articulation traitée la première a donné un bon résultat pendant 2 1/2 ans, mais la mobilité est ensuite allée en diminuant. Les deux jointures opérées en dernier lieu se sont progressivement, tout à fait enraidies.

L'auteur s'en réfère à l'explication que donne FROSTAD du développement de l'articulation — et de la façon dont on peut supposer que cette anomalie se produit — et il considère comme probable que les rudiments musculaires existent au stade embryonnaire de la vie, voire que ces muscles sont encore présents à la naissance, mais qu'ensuite ils s'atrophient assez rapidement.

Les opérations montrèrent aussi que la musculature de coude était présente, bien que grevée d'une atrophie considérable (ou d'une absence de développement?) frappant aussi bien les muscles que le tendon du triceps. Fait digne de remarque: c'est dans le bras opéré le plus tôt qu'ils étaient le mieux développés. Il faut donc exécuter l'opération à l'âge le plus tendre possible si l'on veut escompter un résultat quelconque. Et l'auteur croit que l'opération mérite d'être tentée, parce qu'une meilleure technique et des soins post-opératoires plus attentifs donneraient probablement des résultats plus favorables que ceux rapportés ici.

La croissance du membre ne saurait être compromise par l'opération attendu qu'il n'existe pas de cartilages de conjugaison dans ces cas. Si une ankylose se reproduisait il faudrait chaque fois prendre soin d'assurer à la jointure la meilleure position possible — et dans la plupart des cas le pouvoir de rotation serait vraisemblablement conservé.

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Intervertebral Foraminotomy.

By

CARL HIRSCH, M. D.

During the years elapsed since herniated lumbar discs were first operated in Sweden, a great deal of work has been bestowed upon endeavours to find a reliable method of level diagnostics. The clinical diagnostic methods have been developed *i. a.* through NORLÉN's researches, and the roentgenological possibilities of establishing the position of the prolapse by means of myelography have increased. At this Orthopaedic Clinic we have now exchanged lipiodol and air for abrodile as a contrast medium. Abrodile gives distinct pictures, and the dural sac as well as the nerve roots within their sheath-covered areas are well discernible on the myelograms. Since abrodile, as far as we have been able to judge on the basis of 170 cases, does not involve any risk of adhesive meningitis, it permits us to extend the indications for myelography. It is also our experience that, in most cases, the clinical and myelographical findings agree with the operative ones.

In several publications LINDBLOM has emphasized the importance of the lateral disc prolapses, *i. e.* those situated at the foramen intervertebrale (here called lateral prolapses), and he is inclined to believe that they are more frequent as cause of sciatica than such prolapses as are situated medially to the foramen intervertebrale (here called medial prolapses). To prove the presence of these lateral prolapses he has been working with section material. However, our experience of clinical material (about 550 cases operated) speaks in favour of the assumption that the medial prolapses are the most frequent ones.

Considering that myelography does not allow the diagnostic of the lateral prolapses and that the common method of performing a laminectomy with preservation of the intervertebral joint does not allow the exclusion of a lateral prolapse, one is perhaps justified in saying that, clinically, the possibility pointed out by LINDBLOM has not been sufficiently noticed. However, the fact that chiefly "medial" laminectomies have given positive operative findings, involving discovery of prolapses, seems to indicate that the *clinical* importance of the lateral herniated discs cannot be very great.

One must ask oneself what the reason may be for this difference between clinical symptoms and anatomical findings. Maybe it is not the mere existence of a prolapse pressing the nerve root that occasions sciatica, but perhaps a pressure of a prolapse against the counterpressure of a bone or a ligament is required. Further, it is possible that the sciatic pain is occasioned by the intermittent pressure due to the fact that prominences of various kinds give altered spatial conditions in the foramen intervertebrale at movements in the vertebral column. In previous works FRIBERG has pointed out the importance of the diminution of space (protrusions, osteophytes) in the foramen intervertebrale to the rise of root compression. The fact that the nerve root rides over a prominence — whether a prolapse, a disc protrusion, or an osteophyte — need not, perhaps, give sciatic symptoms.

The pathologico-anatomical mechanism of the rise of sciatica would not seem to differ if the prolapse is situated at the level of, or medially to, the foramen intervertebrale. On the other hand, it may be called into question whether such herniated discs as are lateral in relation to the foramen intervertebrale cause sciatica in a clinical sense. It is conceivable that the difference between our clinical and LINDBLOM's anatomical experiences lies therein. One must, however, reckon upon the possibility that certain cases with clinical signs of root compression but with negative myelogram may be explained by herniated discs situated in the foramen intervertebrale. At the Orthopaedic Clinic we have therefore, on some occasions, performed partial or total resection of the intervertebral joint and then found prolapses in, or just medially to, the foramen intervertebrale. (FRIBERG has 3 unpublished cases; in two of them prolapses were found.)

The intervertebral joint has undoubtedly an important function to fulfil in the statics of the vertebral column, and a resection

of this joint is, perhaps, a fairly essential intervention. The case is that we do not know so far to what extent such an articular resection will cause the patient discomfort in future.

In the July 1945 issue of the *Journal of Bone and Joint Surgery* BRIGGS and KRAUSE describe 35 operations where *intervertebral foraminotomy* has been performed, *i. e.* a resection of the intervertebral joint with exploration of the foramen intervertebrale. The authors found herniated discs in 5 cases. In 22 cases they performed decompressive foraminotomy, and in 7 of them there existed space reducing prominences. In 8 cases bilateral foraminotomy was made in bilateral sciatica. Fusion took place in all cases. BRIGGS and KRAUSE state that an opinion cannot as yet be formed as to the final results. So far, however, the results have been satisfactory (in some instances a follow-up period of four years).

Having recently performed two foraminotomies with positive findings of herniated discs, without accomplishing spinal fusion, the author feels that some views would be of value.

Case 1. (J. No. 3790/45.) Ironworks worker aged 29 years. Sciatic pains since 1941, at times with pains radiating down the left foot. Observed at the Orthopaedic Policlinic for three months. Conservative treatment with a plaster-of-Paris corset brought no relief. Admitted to the Clinic for further investigation.

Status: Back without essential remark. Lasègue left 60 degrees, right 75 degrees. Patellar reflexes vivid and equal bilaterally. Plantar and Achilles reflexes not producible on the left leg. Right without remark. The strength of the left extensor hallucis slightly decreased, right without remark. Superficial sensibility reduced but not entirely lost round the left lateral foot-edge.

Roentgenogram of lumbar spine: At the superior margin of the vertebral body of L. 4 there is an osteophyte, and at the superior margin of the vertebral body of L. 3 a small osteophyte. Intervertebral spaces of normal height.

Myelography with abrodile: No pathological changes.

The patient has thus a long anamnesis; he is at times incapacitated. During the past three months he has been unable to work. The clinical examination indicates root compression lumbosacrally, but the myelogram has turned out to be negative.

As the possibility of a laterally situated prolapse cannot be excluded in this patient, an operation is proposed to him.

Foraminotomia lumbosacralis sin.: Spinous processes and arches are dissected free from muscle tissue on the left side between S. 1 and L. 4; on the right side the muscle tissue is not reflected. Lig. flavum is removed between L. 5 and S. 1. The articular facet of L. 5 is resected with a chisel, and so is half the articular facet of S. 1. Moderate bleeding,

which is controlled by peroxide-of-hydrogene tamponade. — After the dural sac has been moved medially, a swollen nerve root is found. Having moved also this root medially, one can observe a defined bulge from the intervertebral disc — an unmistakable prolapse lying in the foramen intervertebrale, just medially. After an incision into the vertex of the prolapse, two entirely detached pieces are removed.

The postoperative course without complications. After 7 days the patient left hospital painless in the legs and, practically speaking, painless in the back.

Case 2. (J. No. 19849.) Married woman aged 36 years. Trouble from the back with tiredness and pain for 17 years past. During the 1930's the patient wore a cloth corset and improved. After a delivery in 1943 the trouble increased, with pain in the lumbar region. Nothing gynaecological. A roentgenogram in 1943 displayed a considerable reduction of the height of the intervertebral disc between L. 5 and S. 1. Was treated conservatively during the last year at the Orthopaedic Clinic with a plaster-of-Paris corset and physical treatment, giving a temporary effect. Up to October 1945 no radiating pains in the legs; no clinical criteria of a disc prolapse. — In October 1945 suddenly intense radiating pains in the left leg down to the popliteal space. Annoying coughing and sneezing pains.

Status: Back stiffened with pain, reduced mobility. Throbbing pain lumbosacrally with radiation down the left leg. Lasègue pos. left 45 degrees, right negative. Patellar reflexes pos. and equal bilaterally. Left Achilles and plantar reflexes missing, right Achilles reflex faint, right plantar reflex missing. The strength of the extensor of the left great toe reduced. No reduction of the sensibility.

Myelography with abrodile: No pathological changes.

Also in this case the examination pointed to a root compression, despite the negative myelogram, and we decided to propose an operation on the suspicion of a prolapse in the foramen intervertebrale.

Foraminotomia lumbosacralis sin.: Adopting the same method as in the previous case, the lumbosacral space was exposed and the ligamentum flavum removed. The articular facet of L. 5 in the intervertebral joint was chiselled off and half the articular facet of S. 1. was likewise removed. Further, for the sake of better accessibility, about 3 mm. of the arch of L. 5 and an equal portion of the sacrum were removed. The nerve root, when dissected out, proved to be hard squeezed against the articular facet of S. 1. After the nerve root had been released and moved medially, a large disc prolapse was found. After an incision into the prolapse, three large detached pieces of cartilage could be taken out.

During the intervention moderate bleeding, which could be controlled with peroxide-of-hydrogene tamponade.

No postoperative complications. After the lapse of 17 days the patient was discharged, completely painless in the legs and, practically speaking, also in the back.

In the cases described above it admits of argument as to whether, primarily, one ought not to have supplemented the operation by a fusion, considering the risk of spinal discomforts arising later on. A mere removal of the prolapse implies a short stay in hospital. If a fusion had been performed, this would have resulted in a stay in hospital of much longer duration. Moreover, there is always the possibility of performing a fusion later on, should the patient have back pain in future.

Summary.

The author describes two cases of prolapse of the disc with clear neurologic signs of root compression but with negative myelograph. Both cases were operated on with a resection of an intervertebral joint. In both cases a prolapse of a disc was encountered situated in the foramen intervertebrale. The prolapses were extirpated. The primary results were satisfactory and the patients were discharged from hospital free from pain.

. Zusammenfassung.

Verf. beschreibt zwei Fälle von Zwischenwirbelscheibenprolaps mit deutlichen neurologischen Anzeichen einer Wurzelkompression, aber mit negativem Myelogramm. Beide Fälle wurden operiert, wobei ein Intervertebralgelenk abgetragen wurde. Bei beiden Fällen wurde ein im Foramen intervertebrale gelegender Zwischenwirbelscheibenprolaps gefunden. Die Prolapse wurde abgetragen. Das primäre Ergebnis war gut, und die Kranken konnten schmerzfrei entlassen werden.

Résumé.

L'auteur décrit deux cas de prolapsus discal avec des signes neurologiques évidents de compression radiculaire mais où le myélogramme restait négatif. Tous deux furent opérés et l'on réséqua une articulation intervertébrale. Les deux fois on trouva une hernie du disque, située dans le trou intervertébral. Ces prolapsus furent extirpés. Le résultat immédiat fut bon et les malades, à l'exeat, étaient délivrés de leurs douleurs.

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Über die chirurgische Behandlung des idiopathischen Megacolons (der Hirschsprungschen Krankheit).

Von

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Die Behandlung dieses Gegenstandes an dieser Stelle scheint mir nicht nur durch den Umstand gerechtfertigt, dass die HIRSCHSPRUNGSche Krankheit zwar stets schon in den Kinderjahren anwesend ist, aber es kommt oft erst jenseits derselben zu einer zweckmässigen Behandlung. Man kann dies in der Regel nur bedauern. In deutscher Sprache hat meines Wissens nur PÄSSLER diesen Gegenstand ausführlich behandelt. Seine vortreffliche Darlegung anlässlich dreier operativer Fälle — es waren keineswegs Vollerfolge — ist die Basis, die jeder neueren Arbeit, auch der hier vorliegenden, zum Ausgangspunkt dient.

Diese Besprechung will jedoch mehr als eine sich auf Kasuistik stützende Publikation sein. Denn sie will zugleich die Aufmerksamkeit darauf hinlenken, dass die alte Morphopathologie mit ihrer eventuellen Quasifundierung unseres ärztlichen Wissens und darauf dann zu Unrecht gebaute, anatomisch gedachte Chirurgie in mancher Hinsicht das Feld für funktionell-pathologische Ansichten und infolgedessen für eine funktionelle Chirurgie räumen muss. Davon ist das idiopathische Megacolon ein treffendes Beispiel.

Die HIRSCHSPRUNGSche Krankheit, eine seltene Abweichung, angeboren oder wenigstens schon in der frühen Jugend in der Anlage vorhanden, war von alters her ein Beispiel monstruöser, anatomischer Pathologie. Als Grundlage eines oft missgestaltig

angeschwollenen Bauches und von immer wieder wochenlang anhaltender Verstopfung wurde dabei eine enorme Anschwellung eines kleineren oder grösseren Teiles des Dickdarms, mit Hypertrophie der Muskelwand, gefunden. Manchmal — in ernstesten Fällen — konnte man den ektatischen Darm, eventuell »Darmsteifung«, durch die Bauchwand hindurch sehen oder wenigstens palpieren. Häufig war die Anschwellung des Darms auf das Sigmoid beschränkt; fast immer ist das Sigmoid mit angeschwollen. Es hat denn auch nicht an Publikationen gefehlt, in welchen eine sigmorektale Klappe oder Abknickung als Ursache der HIRSCHSPRUNGSchen Krankheit beschrieben wurde, und auch jetzt ist letztere noch nicht ganz aus rezenten Artikeln verschwunden. Dies stimmte früher mit dem ausschliesslich morphologischen Geiste der Zeit überein, und befriedigte sein Kausalitätsbedürfnis offenbar vollkommen. Es muss seinerzeit wohl recht viel Mut benötigt sein, einzugestehen, dass man diese Klappe oder dergleichen nicht gefunden habe, da man sich damit in den Augen der meisten als unzuständig hinstellte. Doch gab es Tatsachen, die mit der Lehre von Klappe oder Knickung schwerlich im Einklange zu bringen waren: die meistens recht scharfe Begrenzung des Megasigmoid(-colons) an der oralen Seite war davon ein Beispiel; eher hätte man infolge eines mechanischen Hindernisses eine allmähliche Zunahme der Ektasie erwarten dürfen.

Mit Hilfe interner, medikamentöser Mittel (Laxantia, Clysmata) liess sich von alters her sehr wenig, namentlich wenig Dauerndes, in einigermassen ernstesten Fällen der HIRSCHSPRUNGSchen Krankheit erreichen. Unterernährung, Pneumonie, mit infolge des hochgedrängten Diaphragmas, sind beachtenswerte Todesursachen. Komplikationen, besonders Volvulus des Megasigmoids — und Darmnekrose — kamen noch hinzu und brachten die Gesamtsterblichkeit auf die Dauer über 50 %. Das ausgedehnte Colon (Sigmoid) mit seiner dicken Muskelwand enthält gewöhnlich einige Liter Inhalt: harte Skybala, breiige bis dünne Fäzes und eventuell grosse Mengen Gas. Trotzdem verspüren die Patienten nicht oder kaum Drang zu Defäkation, höchstens ein volles Gefühl im Bauch. Der Zustand pflegt lange kompensiert zu bleiben: Anhäufung in den vorangehenden Darmteilen, namentlich im Dünndarm, fehlt lange; Appetit und Ernährungszustand bleiben lange intakt. Zu Erbrechen kommt es — abgesehen von Volvulus — erst in extremen Stadien.

In der letzten Zeit hat die medikamentöse Therapie (LAW,

SCHIPPERS) sich auch der Parasympathikomimetika (u. a. Doryl) und verwandter Stoffe (Prostigmin) bemächtigt, die schon eher aus der funktionellen Megacolon-diagnostik der Chirurgen bekannt sind. Es ist nicht daran zu zweifeln, das lange dauernder Gebrauch — c. q. Einspritzung — solcher Pharmaka hilft, wenigstens, solange die Medikation dauert. Dies ist dann ein therapeutischer Erfolg, ebenso wie derjenige der Insulintherapie bei Diabetes. Als Chirurg ist man leicht geneigt — übrigens mit aller wissenschaftlichen Schätzung dieses Mittels — dasselbe mit dem lebenslangen Tragen einer Prothese zu vergleichen, nicht mit der operativen Heilung einer Pseudarthrose. Vielleicht gelingt es auch, dieser modernen Pharmakotherapie bei lange dauernder Anwendung operativer Hilfe, vorläufig oder auf die Dauer zu entkommen.

Eine scharfe Trennung von Megacolon und Dolichocolon scheint auch mir, ebenso wie LERICHE, erkünstelt: das weite Megacolon ist in der Regel auch zu lang; das lange Dolichocolon ist meistens zugleich reichlich weit, wenn auch nicht so extrem.

Was unternahm der Chirurg von alters her, und was erreichte er damit? Abgesehen von palliativen Massnahmen (Colostomie, Coecostomie, Colopexie, Coloplikation), die entweder vorübergehender Art waren, oder wenigstens sich als sehr unbefriedigend erwiesen, gab es eigentlich allein die radikale Resektion des Megasigmoids, bzw. Megacolons, mit einer Sterblichkeit von einigen Dutzenden Prozenten! Einige glücklich gelungene Megacolonresektionen beweisen keineswegs, dass die operative Mortalität jetzt nennenswert abgenommen haben sollte: die noch immer beträchtliche Sterblichkeit bei Resektionen des linken Teiles des Colons, z. B. wegen Karzinoms bei Erwachsenen macht dies auch nicht annehmlich. Rezidive nach Darmresektion wegen Megacolons waren doch nicht ausgeschlossen, namentlich nicht nach denjenigen Colonresektionen, welche vorsichtshalber als »Vorlagerung« in zwei Tempi unternommen wurden. Dies war begreiflich: auf diese Weise blieb wohl immer an der analen Seite des resezierten Teiles ein Stück *Megasigmoid*, bzw. *Megapelvinum* zurück. Ein an der oralen Seite zurückgebliebener ektatischer Darmteil war offenbar mit operativer Heilung nicht unvereinbar. Überdies liessen diese Operationen die seinerzeit nahezu unbekannte, begleitende Pathologie des uropoetischen Apparates unberührt, was für das weitere Leben von Bedeutung werden könnte.

Mehr oder weniger widerstrebend kam man jedoch dazu, einzustehen, dass bisweilen, oft, meistens, ja eigentlich immer wenig Glaubwürdiges von einer morphologischen Ursache der Ektasie des (Mega-)Colons zu finden war. Zugleich lernte man »andere« Formen von »symptomatischem« Megacolon bei Patienten mit Krankheiten des somatischen Nervensystems kennen, nicht nur bei Tabetikern. Dies führte auf die Vermutung, dass Störungen in der Innervation, also in dem Gebiet des autonomen Nervensystems eine, ja, sogar die Ursache des »idiopathischen« Megacolons und zugleich der damit wiederholt verbundenen Megacystis sein könnten. Eine wesentliche Stütze für diese Ansicht lieferte nicht allein der Umstand, dass nach Rektumoperationen infolge Läsion sakralautonomer, parasymphathischer Nerven manches Mal eine (vorübergehende) Megacystis gefunden wird. In Tierversuchen (ISHIKAWA, KLEINSCHMIDT) konnten sowohl Megacolon als Megacystis durch entsprechende, absichtliche Nervenläsionen erzeugt werden! Den Schlussstein zu dieser Konstruktion bildet jedoch der Erfolg der sich daraus ergebenden operativen Konsequenz; siehe später.

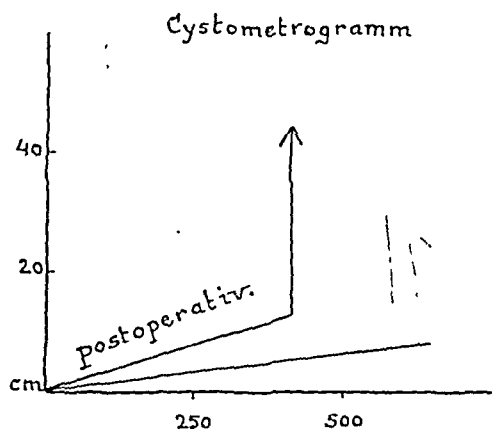
Wie weit der N. vagus reicht, wo der sogen. N. Pelvicus an dem (Dick-)Darm beginnt, lässt sich, namentlich in bezug auf KURÉS spinalen Parasympathicus, nicht leicht sagen. Es scheint mir namentlich nicht möglich, dies auf anatomischem Wege, also präparatorisch, zu entscheiden.

In Anbetracht der Tatsache, dass das orthosymphathische Nervensystem (die thorakolumbalen Nn. splanchnici) Tonus und Peristaltik des ganzen Magendarmkanals hemmt, umgekehrt das parasympathische (in casu die sakralen Nn. pelvici) als Aktivator bekannt ist, hat man also die Wahl, eine der beiden Sachlagen anzunehmen: Als neurogene Ursache eines atonischen Megacolons nahezu ohne Peristaltik kann übertriebene Sympathicuswirkung, jedoch auch unzulängliche parasympathische Innervation in Betracht kommen. Ein Zusammenwirken beider wäre auch möglich. Mit Sicherheit kann man vorläufig nicht mehr sagen, als dass die orthosymphathische Innervation verhältnismässig die Oberhand haben muss, und für die chirurgische Therapie ist dies glücklicherweise genug.

Man könnte sagen, dass sich die Frage nach der Pathogenese nunmehr nach neuromorphologischem Terrain verschoben hat, einerlei, ob zentral oder aber peripher gesucht werden muss. Die Daten bezüglich vielleicht ursächlicher, mikroskopischer Abweichungen in operativ

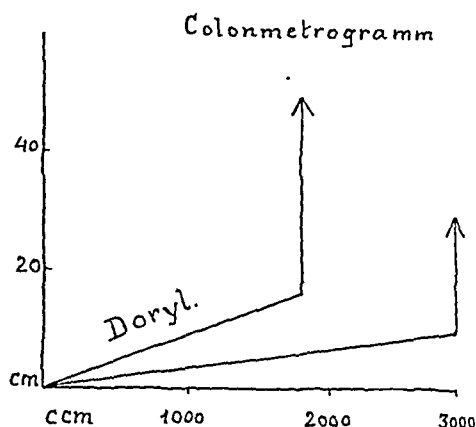
entfernten Ganglien und Nerven widersprechen einander, sind wenig überzeugend. Übrigens wäre eine funktionelle Störung der autonomen Innervation ohne morphologisches Substrat sehr wohl akzeptierbar. Bei dem Megacolon in den ersten Lebensmonaten ist man wohl zu der Idee eines dann noch nicht ausgewachsenen örtlichen Nervensystems gekommen: damit schielte nach alter Gewohnheit das Bedürfnis an einer *neuromorphologischen* Ursache eben wieder um die Ecke.

Therapeutisch könnte man also wünschen: Verstärkung der Pelvicusfunktion, die chirurgisch = dauernd nicht verwirklicht werden kann, allein pharmakologisch — durch Doryl, Prostigmin usw. — zeitweilig erreichbar ist, oder aber eine Verschwächung der orthosympathischen, inhibitorischen Innervierung durch Resektion oder Durchschneidung ihrer Bahnen. Zu diesem Zwecke haben WADE und ROYLE die diesbezüglichen Rami communicantes gespalten; dieses Verfahren wurde fallengelassen. Man kann den Plexus hypogastricus superior (impar) = den sog. N. praesacralis reseziieren — eventuell beide Nn. splanchnici opfern. Nach ADSON kann man die Resektion beider lumbaler sympathischer Grenzstränge hinzufügen, casu quo auch noch den Plexus mesentericus inferior (bei dem Ursprung der gleichnamigen Schlagader) eliminieren. Durch derartige Operationen — man kann innerhalb gewisser Grenzen eine Wahl treffen, bezw. individualisieren — die, falls sie nicht in extremis ausgeführt werden, verhältnismässig ungefährlich sind, erzielt man laut dem Schrifttum Heilung oder erhebliche Besserung in zwei Dritteln der Fälle; gemeint ist: subjektive Verbesserung. Objektiv ist die funktionelle Heilung häufiger, und sie kommt eher zustande als eine morphologische Verbesserung: wenn auch das Colon zu weit bleibt, können der Tonus und die Peristaltik nichtsdestoweniger normal werden. Nicht immer wurde die orthosympathische Denervierung gleich radikal ausgeführt. Es ist denn auch kaum zu bezweifeln, dass das Resultat bei gründlicherer Sympathektomie und früherem Operieren noch günstiger wäre. Leider kommt der Chirurg so manches Mal zuletzt an die Reihe, wenn der Internist sein in dieser Hinsicht sehr mangelhaftes Arsenal erschöpft hat. Und dann kommt es noch vor, dass dieser die Art der Operation vorschreiben will, während ihm doch billigerweise höchstens eine beratende Stimme zuerkannt werden kann. Man muss nicht warten, bis die klinische Diagnose — abgesehen von einigen differential-diagnostischen Momenten — retroperitoneale Tumoren, auf den ersten Blick gestellt werden kann, bis dass das lange dauernde Stadium des kompensierten, lokal-atonischen Ileus so gut wie



I

Abb. 1 a vom 1. Fall.
Cystometrogramm vor und nach der
Sympathectomie.



III

Abb. 1 b vom einem 3. Fall, der nicht
zur Operation gelangte (verzogen!).
Colonmetrogramm vor und nach der
Doryl-Einspritzung. (Funktionstest.)

vorbei ist. In welchem Alter man operieren muss, lässt sich nicht universell feststellen: dies hängt mit von dem Grad der Krankheit ab. Sympathektomie-Operationen werden auch in jüngerem Alter mit gutem Ergebnis durchstanden als Darmresektionen, die bei Kindern unter etwa 6 Jahren nahezu ausgeschlossen sind. Doch vor dem 20. Jahre sind die Beschwerden wohl immer derart geworden, dass Grund zur Röntgenuntersuchung besteht und dann ergibt sich die Situation wohl. Diese Röntgenuntersuchung muss vorzugsweise mit per os verabfolgten Kontrastmitteln erfolgen; das Kontrastklysma ergibt — auch nach der Operation — Bilder, welche zu sehr von dem Druck, mit dem es hineingebracht wurde, abhängig sind.

Die Indikation zum Operieren zwingt um so mehr, da — ausser in leichten Fällen — nahezu keine Aussicht auf spontane oder medikamentöse, dauernde Heilung besteht. Man muss jedoch nach dem Megacolon spüren, nicht warten, bis es sich aufdrängt, wenigstens, wenn man die reifen Früchte der funktionell-chirurgischen, modernen Sympathektomie-Operationen ernten will.

Fall I. Ein 19-jähriger junger Mann war vor kurzem Waise geworden, und infolgedessen musste seine Schwester die Lasten seiner Versorgung tragen. Da bei ihm zeitweilig der Stuhlgang bei Tag und Nacht spontan erfolgte und dann in Windeln aufgefangen ward, wurde für ihn Hilfe wegen Incontinentia alvi nachgesucht; nachts harnte er auch wohl einmal in seinem Bett. Der Patient schien mir auch geistig nicht ganz vollwertig. Ein Bruder von ihm soll wegen ähnlicher Symp-

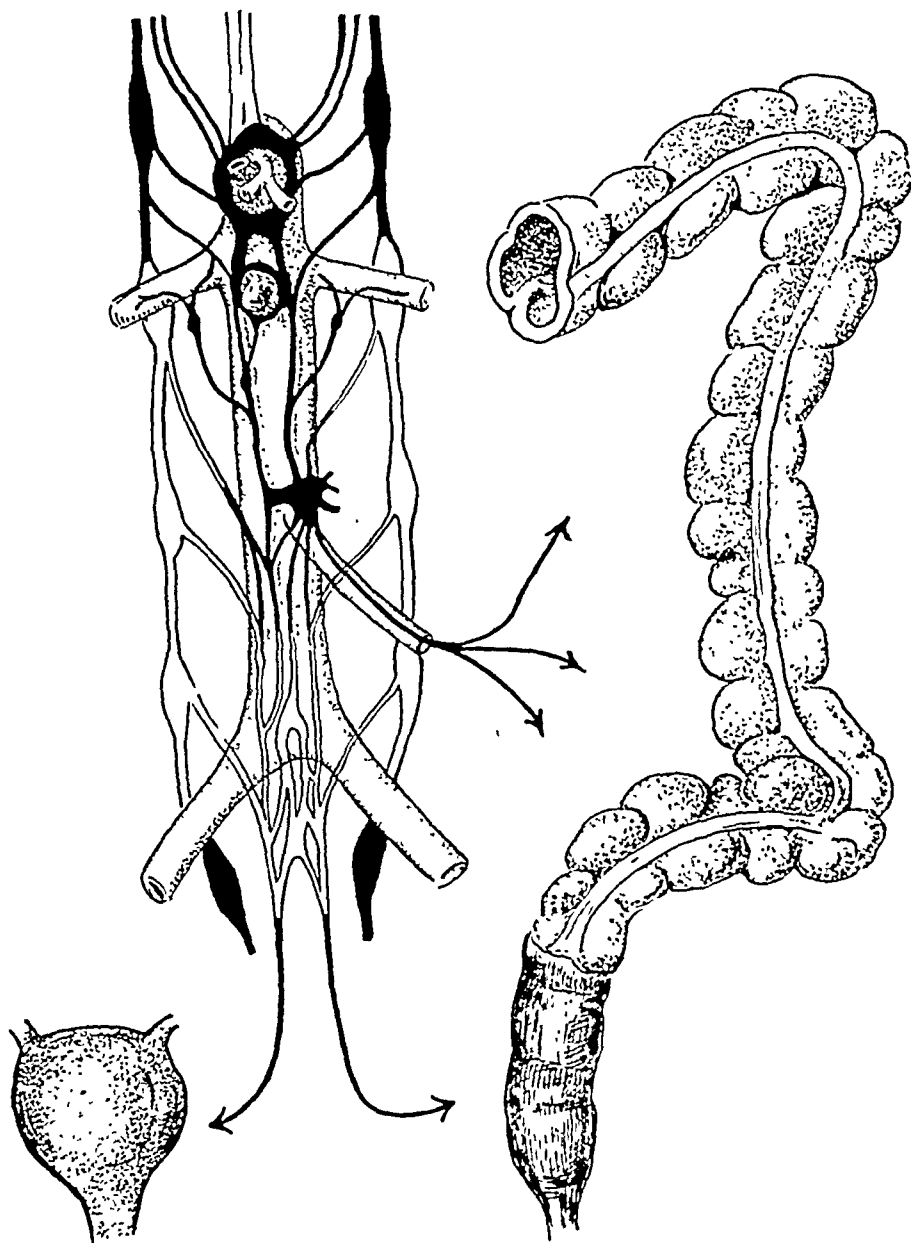


Abb. 2 vom 1. Fall.

Sympathectomie-Schema nach *Adson-Pässler*. Lumbalgrenzstränge und Plexus hypogastricus reseziert: Megasigma, Megarectum und Megacystis.

tome mit tödlicher Folge operiert sein; dies hatte die verstorbene Mutter vom Nachsuchen ärztlicher Hilfe für diesen Sohn abgeschreckt. Er war mit einem nicht durchgebrochenen Anus zur Welt gekommen; dieser war operativ geöffnet, und die Familie sprach denn auch von der Diagnose eines fehlenden Schliessmuskels, was a priori nicht unwahrscheinlich schien. Ich habe den Patienten erst für neurologische Untersuchung nach der Poliklinik Prof. BROUWERS verwiesen: dort wurden, ausser

Störungen in der Innervation der Augenmuskeln, im somatischen Nervensystem keine Abweichungen gefunden, die in näherem Zusammenhange mit den Darmsymptomen gebracht werden konnten. Der Patient wurde danach in die chirurgische Abteilung zwecks Erwägung des Anlegens eines Anus praeternaturalis aufgenommen. Es zeigte sich dort bei Touchieren schon bald, dass der Sphincter ani keineswegs

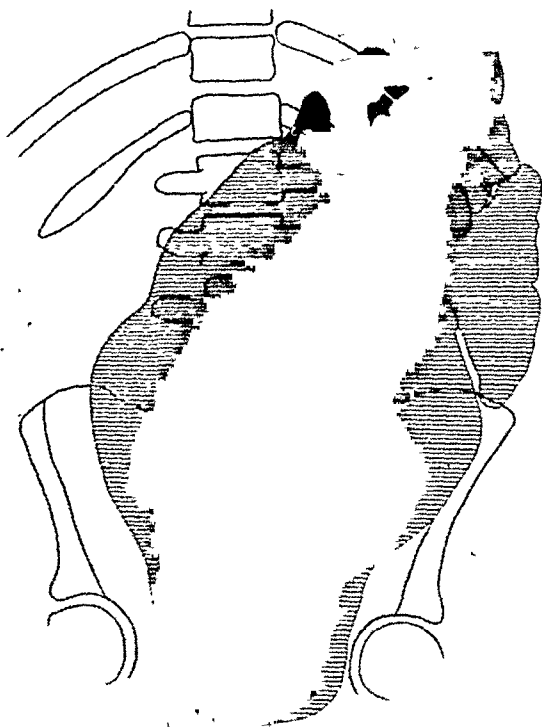


Abb. 3 vom 1. Fall.

Kontrastbild von Sigma und Rectum: Schraffiert: vor der Operation
vollscharz: nach derselben.

fehlte. Bei genauerem Aufnehmen der Anamnese ergab sich Folgendes. Zwar war der Patient seit der Geburt den Windeln noch nicht entwachsen, doch die Incontinentia alvi war nur periodisch; die Zeiten dieses anormalen Stuhlganges wechselten mit Perioden von 2—3 Wochen, in welchen überhaupt kein Stuhlgang erfolgte, ab. Von einfacher Inkontinenz war also keine Rede; Retention und zeitweilige Entleerung wäre die richtigere Benennung. Nichtsdestoweniger blieb der Gedanke an eine postoperative Strictura recti vorläufig bestehen. Und als Orientierung, die operativer Hilfe voranzugehen hat, wurde Röntgenuntersuchung des distalen Colons beschlossen. Besonders die Länge des Sigmoids und Colon pelvinum interessierte mich in Hinblick auf eine

eventuelle, die Kontinuität wiederherstellende Operation am Mastdarm. Und sollte vielleicht doch ein typisches Megacolon bestehen, dann würde sich dies zugleich zeigen und müsste ein ganz anderer therapeutischer Weg eingeschlagen werden. Bereits bei dem Hineinbringen des Kontrastklysmas zeigte sich, dass eine sehr grosse Menge — reichlich $2\frac{1}{2}$ Liter — von dem Patienten vertragen wurde. Der Patient war auch noch von kleiner Gestalt! In den Photographien waren Rektum und Sigmoid sehr weit, atonisch. Die anderen Därme mussten wohl weit verdrängt sein; das Coecum von ziemlich normalem Umfange lag gegen die Leber angedrückt. Von einer Striktur im Rektum selbst — als Rest der Operation beim Neugeborenen — zeigte sich nichts; von einer Falte oder dergleichen auf der Grenze von Sigmoid und dem (darüber ebenso weiten) Rektum war ebenfalls nichts zu sehen. Damit wurde eine zufällige Koinzidenz: früher Anus imperforatus, jetzt noch Megacolon, namentlich Megasigmoid, sehr wahrscheinlich. Bei näherer Betrachtung des Perineums war dort auch von der Operation beim Neugeborenen nahezu nichts sichtbar: mehr als Inzision eines Anus imperforatus konnte schwerlich stattgefunden haben, namentlich fehlten sichtbare Reste eines ausgiebigeren Eingriffes wegen Atresia recti: somit brauchte der Schliessmuskel auch keineswegs zu fehlen.

Es ist übrigens bekannt, dass das »symptomatische« Megacolon beim Neugeborenen mit Anusatresie sehr bald zum normalen Umfange zurückkehrt.

Um absolute Sicherheit zu erhalten, dass bei diesem Patienten ein echt »idiopathisches« Megacolon bestand, wandte sich die Diagnostik nunmehr dem uropoetischen System zu. Das Megacolon nämlich, das auch das Rektum nicht freilässt, pflegt mit Megacystis und Megaureteren, also mit seltenerem Harnen, verbunden zu sein.

Schon ein einfaches Cystogramm, das durch Hineinbringen von Jodnatrium in die Blase erhalten wurde, liess keinen Zweifel bezüglich der Megacystis. Sogar die Megaureteren waren darauf zu sehen; (also bestand Reflux, Insuffizienz der Ureterostia). Schliesslich wurde der Weg der Cystometrie oder Cystometrographie eingeschlagen: man spricht auch wohl von Cystomanometrie. Man stellt dabei fest, welcher intravesikale Druck in der Blase bei verschiedenen Füllungsgraden besteht und legt dies in einer graphischen Darstellung fest. (Die entsprechende, schmutzige Colonmetrographie unterliess ich.) Das Ergebnis war Atonie der viel zu geräumigen Blase: bei einer Füllung bis zu 600 ccm herrschte erst ein Druck, der für 300 ccm hätte normal sein müssen! Damit war jeder differentialdiagnostischer Zweifel nun wohl von der Bahn. Es konnte somit vor der operativen Hilfe nur noch von funktioneller Präzisierung der Indikation die Rede sein. Zu diesem Zwecke wurde Doryl, ein Parasympathikomimetikum, eingespritzt: die Folge war eine beträchtliche Erhöhung des intravesikalen Druckes und parallel hiermit eine erhebliche Verengerung des Megacolons auf der Röntgenphotographie, auf welcher nun auch Kontraktionswellen nicht mehr ganz fehlten. Der Patient verspürte denn auch Krämpfe im Unterleib. Die pharmakologische Unterstützung der parasympathischen Innervation (Pelvicus) verursachte also denjenigen Effekt,

den man sich von der chirurgischen Therapie wünschen möchte, wenn diese auch glaubt, dies durch Schwächung, Ausschaltung des *N. orthosympathicus* zu erreichen. An dem Bauch konnten die Umrisse des ausgedehnten Colons, auch nach der Einspritzung von Doryl, nicht wahrgenommen werden; auch durch Palpation gelang es nicht, den Iektatischen Darm zu begrenzen.

Nach einer gründlichen Vorbereitung mit Klysmata und Laxantia (zu lange darf dies auch wieder nicht dauern; denn dies würde den Patienten zu viel schwächen) und mit Hilfe einer Transfusion, wurde eine ausgiebige Sympathektomie nach ADSON ausgeführt.

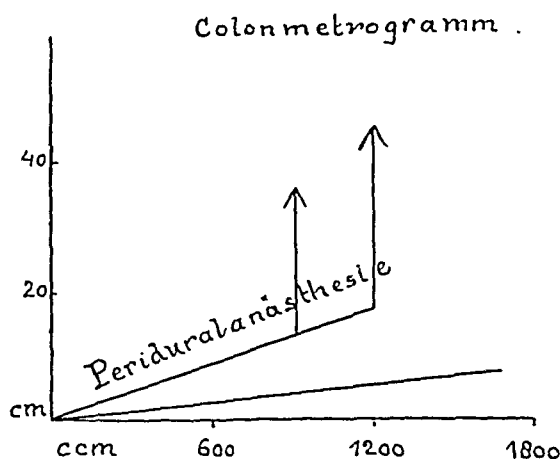
Via eine mediane Inzision, fast von der Symphyse bis über den Nabel, wurde der Dünndarm weggesteckt. Das riesige Sigmoid — es war kollabiert beinahe 15 cm breit — wurde nach links gehalten. Zunächst wurde nun der sog. *N. praesacralis* (Plexus hypogastricus superior) reseziert. Zu diesem Zwecke wurde in einem dreieckigen Gebiet vor dem Promontorium das parietale Peritoneum mit allem weiteren Gewebe (bis, auf die *A. sacralis media*) vor dem Ligamentum longitudinale anterius exstirpiert. Als Variation lag die Bifurkation der Aorta hinter derjenigen der *V. cava inferior*, und auch höher als normalerweise.

Darauf folgte die Exstirpation des *linken lumbalen Grenzstranges* im Gebiet der 2.—4. lumbalen Ganglien. Zu diesem Zweck wurde das Mesosigma nach rechts geschlagen, und um dies zu können, teilweise von der hinteren Bauchwand dekolliert. Der linke Ureter wurde abgehoben. Wenn man dann die Aorta descendens bis nach medialwärts verdrängt, wird der Grenzstrang gut zugänglich von der Nierengegend bis dort, wo dieser hinter der *Vasa iliaca* nach dem kleinen Becken verschwindet. Danach lässt man das Sigmoid wieder an seine Stelle zurückgleiten. Schliesslich wurde der rechte Grenzstrang unter dem Nierengebiet exstirpiert. Hierfür braucht man das Coecocolon ascendens keineswegs wie für eine Hemikolektomie zu dekollieren: Wenn man das parietale Peritoneum lateral von der *V. cava inferior* unter der *Radix mesenterii* inzidiert, erreicht man den rechten Grenzstrang ohne weitere Behinderung.

Die peritonealen Defekte rechts von und medialwärts vor der Wirbelsäule wurden geschlossen und die vordere Bauchwand wurde rekonstruiert. Dieses intraperitoneale Verfahren ermöglicht es, alles Gewünschte in *einem* Zuge auszuführen; es ist jedoch bei Megacolon nicht empfehlenswert — in anderen Fällen kan dies wohl geschehen — ohne Dekollieren durch das Mesosigma hindurch den linken Lendengrenzstrang zu attackieren. Bei der Exzision des Plexus hypogastricus superior gehe man nicht weiter lateralwärts als die *Vasa hypogastrica*, vor allem links nicht: man könnte dann Pelvicusfasern gefährden.

Der Patient durchstand die Operation gut; anfangs wurde dem Darm noch mit milden Laxantia (Paraffin) und Klysmata geholfen. Nach einigen Wochen wurde allein mit einem Löffel Paraffin tägliche Defäkation erreicht. Und von der Inkontinenz (auch der nächtlichen für Harn) war nichts mehr zu finden. Dem Patienten geht es gut; sein Bauch ist nicht mehr so »gefüllt« wie vorher. Colonphotographien nach

Kontrastbrei per os zeigen eine wesentliche Verschmälerung des Sigma-Rektums. Die Umrisse sind nicht mehr ganz glatt, atonisch. Eingenommene Holzkohle kommt nach $1\frac{1}{4}$ Tagen in die Fäzes: der Darmkanal wird also noch nicht in der ganz normalen Zeit durchlaufen. Ausserdem ist der Druck in der Blase, verglichen mit demjenigen vor der Operation, erheblich gestiegen. Der Patient harnt denn auch häufiger. Hinderliche Nebenerscheinungen (*wohl* Anhydrosis an den Beinen) sind vorläufig nicht vorhanden, obgleich erwartet werden darf, dass der Ejakulationsmechanismus verlorengegangen sein wird.



II

Abb. 4 vom 2. Fall.
Colonmetrogramm ohne und nach der Periduralanästhesie.
(Funktionstest.)

Fall 2. Für einen 12-jährigen Knaben wurde Hilfe nachgesucht für die immer zunehmende Anschwellung seines »Magens«. Weitere Beschwerden hatte er nicht; nur bei näherer Nachfrage stellte sich heraus, dass er in der Regel 7 bis 10 Tage nacheinander keinen Stuhlgang hatte. Danach war derselbe zuweilen erst mit Hilfe von Laxantia sehr ausgiebig. Dieser Zustand bestand wohl schon Jahre, doch die Beschwerden nahmen nach und nach zu. Der Allgemeinzustand war gut, auch geistig; neurologische Untersuchung ergab keine Besonderheiten. Der Bauch war kaum geschwollen, wohl etwas reichlich gefüllt für einen Knaben seines Alters. Bei tiefer Einatmung jedoch trat die Anschwellung, namentlich oberhalb des Nabels, deutlich zutage. Von vorn gesehen war der Thorax ebenfalls geschwollen, verbreitert, als ob die Bauchorgane in ihm hineingedrungen waren. Das Vermuten eines Megacolons lag mithin auf der Hand, und es wurde durch die weitere Untersuchung bestätigt. Die Röntgenuntersuchung ergab, dass ein evidentes Megasigmoid bestand; das Rektum war nicht erweitert, ebensowenig das orale Colon. Wie erwartet werden durfte, war die Blase nicht erweitert: es bestand keine Megacystis. Auf einem intravenösen Pyelogramm erwiesen sich die Ureteren wohl als etwas breit.

Die Colonmetrographie bewies die Atonie des Sigmiods. Für die Funktionsuntersuchung wurde eine Variante von KIRSCHNERS gürtelförmiger spinaler Anästhesie angewandt, nämlich die peridurale Anästhesie mit einem viskösen Anästhetikum nach DOGLIOTTI-DENECKE, und zwar so, dass Anästhesie vom Rippenbogen bis über die Symphyse hinaus entstand. Dabei wird die orthosympathische Innervation aus den betreffenden Segmenten (Th 6—L 2) auch ausgeschaltet, ohne dass die sakrale Pelvicusinnervation darunter leidet. Darauf folgende Röntgenuntersuchung zeigte, dass zeitweilig eine erhebliche Besserung — Verengung, Peristaltik, die der Patient ausserdem fühlte — zustande gekommen war. Somit durfte erwartet werden, dass ausgiebige operative orthosympathische Denervierung auch wohl ein dauernder Erfolg zeitigen werde.

Die Operation fand seinerzeit nicht ganz so wie in Fall 1, aber wohl transperitoneal, nach einer entsprechenden Vorbereitung, statt. Da das Rektum und die Blase normal waren, wurden dann wohl beide Grenzstränge, aber nicht der N. praesacralis exstirpiert. Die Schwellung des Bauches verschwand und von diesem Zeitpunkt an erinnerten subjektiv wahrnehmbare Darmkontraktionen den Jungen daran, sein Bedürfnis zu bestimmten Zeiten zu verrichten. Röntgenologische Nachuntersuchung sowie erneute metrographische Untersuchung nach 3 Jahren ergaben folgendes objektives Resultat: kontrahiertes Sigmoid mit einem im Verhältnis zu dem Inhalt fast normalen Druck. Für die normale tägliche Defäkation ist sogar kein Paraffin mehr nötig. Per os verabfolgte Holzkohle erscheint nach 24 Stunden im Stuhlgang; die Darmpassage ist also nicht mehr verzögert.

Bei der ADSONSchen Sympathektomie werden also mit den Lenden-grenzsträngen auch an den Beinen autonome Funktionen geopfert, damit der Radikalismus der orthosympathischen Darmentnervung möglichst gesichert sei. Darin liegt der Gegensatz zum Vorgehen nach LEARMONTH, bei dem die Grenzstränge belassen werden, dafür allerdings der Plexus mesentericus inferior stets geopfert wird.

Von diesen beiden allseitig gelungenen Fällen, denen keine verschwiegenen Fehlerfolge gegenüberstehen, ist der erste noch von sehr rezentem Datum. Die Literatur bietet jedoch ein grosses Mass von Wahrscheinlichkeit, dass einmal erzielte Erfolge nicht wieder nachträglich durch dauernde Rezidive Enttäuschung bringen. Allerdings ist in der Regel — und wie es scheint, nach weniger umfangreicher Sympathektomie mehr — Geduld und grosse Sorgfalt bei der Nachbehandlung erforderlich, ehe die Reedukation des Darmes vollbracht ist. Daher muss der Resektion des »N. praesacralis« wenigstens diejenige des linken lumbalen Grenzstranges hinzugefügt werden, am liebsten auch diejenige des rechten oder (bezw. und) des Plexus mesentericus inferior. Einer dieser beiden letztgenannten genügt ersichtlich; mit der Resektion des Plexus mesentericus inferior ist technisch etwas

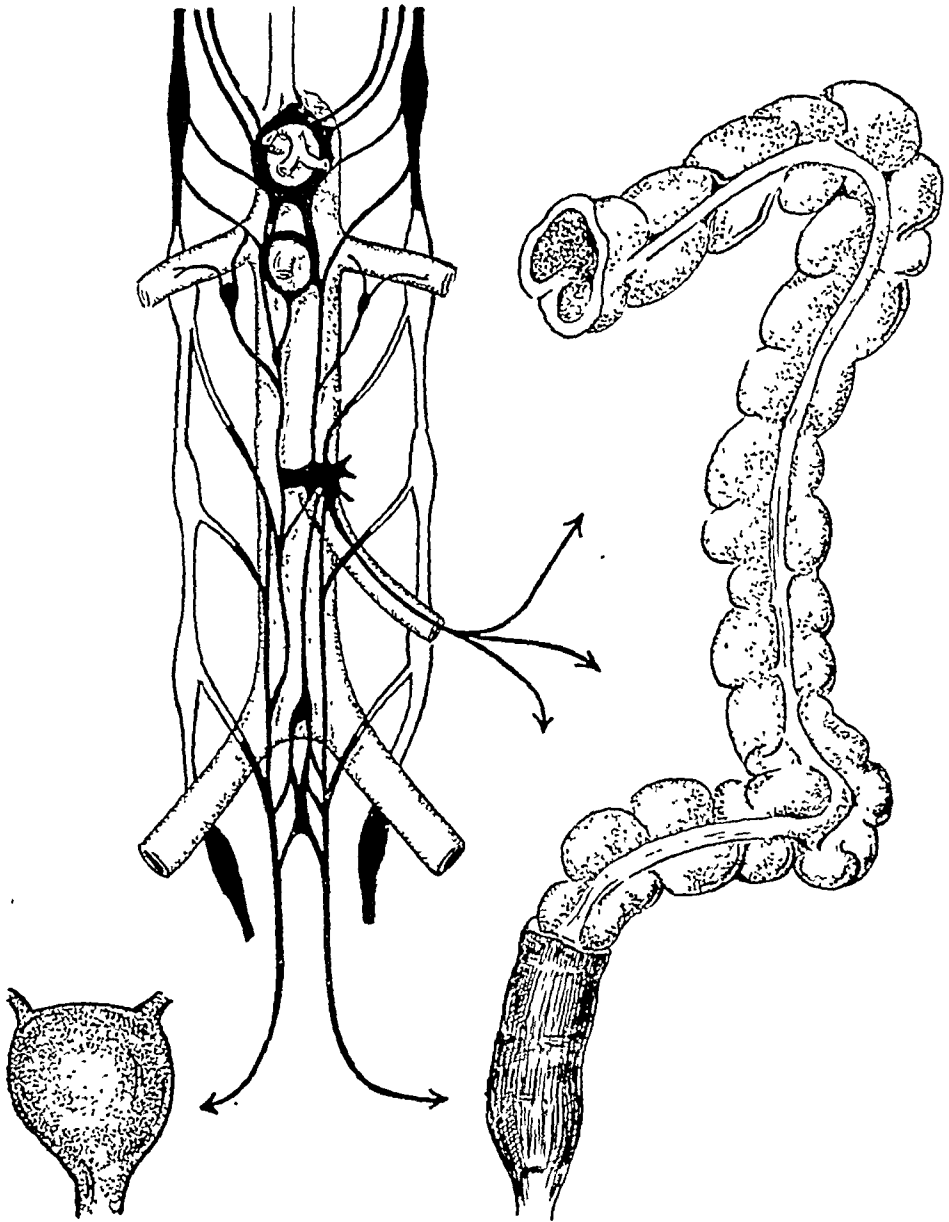


Abb. 5 vom 2. Fall.

Sympathectomie-Schema nach Adson-Pässler »N. praesacralis« (Plexus hypogastricus) erhalten: weder Megarectum noch Megacystis.

Gefahr für Beschädigung parasympathischer Darmfasern verbunden, welche den therapeutischen Effekt zunichte machen könnte. Wenn das ganze Colon, nicht allein das Sigmoid, angeschwollen ist, könnte zu empfehlen sein, die orthosympathische Denervierung höher zu unternehmen: als bilaterale, subdiaphragmatische Splanchnicusresektion mit Exzision des höheren Teiles

des lumbalen sympathischen Grenzstranges, wie auch ich diese nach dem Vorgange ADSONS wegen essentieller Hypertension wiederholt ausführte. Dies erfordert jedoch zwei getrennte retroperitoneale Operationen. Auch dann geht die Ejakulation verloren: die Fasern zu den Samenblasen und Samenleitern kommen durch die oberen lumbalen Rami communicantes über den »N. praesacralis« (Plexus hypogastricus).

Die Mortalität dieser Operationen ist minimal. Allerdings lassen sich noch keine operativen Sterblichkeitsprozentsätze aus grossen Reihen Megacolonpatienten aufstellen. Doch infolge anderer Indikation: bei Hypertension und bei Kreislaufstörungen in den Beinen, sowie auch bei Dysmenorrhöe sind hunderte Grenzstrangresektionen, Splanchniektomien und Exstirpationen des N. praesacralis, häufig kombiniert, mit einer Mindeststerblichkeit von nur einigen Prozenten, vorgenommen worden, wie ich auch selbst erfahren habe.

Überdies sind die Sympathektomie-Operationen auf der richtigen Grundlage der funktionellen Pathogenese basiert. Sie gehören keineswegs allein zu dem Arbeitsfeld des ausschliesslich als Neurochirurg tätigen Kollegen, falls der Operatör die erforderliche anatomische Befähigung besitzt.

Etwas Befremdendes ist in dieser Therapie auf den ersten Blick allerdings. Wenn man Grenzstrangresektionen usw. wegen Megacolons ausführt, ergeben sich keine nennenswerte Kreislaufstörungen; entfernt man jedoch die Grenzstränge wegen Zirkulationsstörungen, dann folgt keine merkbare dauernde Darmstörung! Dies hat man folgendermassen zu verstehen. Bei innermotorischer Darmpathologie verfügt die Nervenversorgung des Kreislaufes unvermindert über Regulierungsmechanismen, die es ermöglichen, den Blutkreislauf normal zu halten. So haben z. B. auch Splanchnicusresektionen bei Gesunden keinen dauernden Effekt auf den Blutdruck, wohl jedoch bei Hypertensionspatienten.

Sollten sich nach ausgiebiger Sympathektomie noch einmal, durch Fahrlässigkeit der Operierten, zeitweilige Rückfälle von Obstipation einstellen, dann hat man immer noch die Parasympathikomimetika (Doryl, Prostigmin) zur Verfügung, zeitweilige Schwierigkeiten zu überwinden. Wenn man diese Mittel schon durchlaufend als Hauptbestandteil der Pharmakotherapie anwendet, hat man bei Exzerbationen in dieser Hinsicht sein Pulver schon verschossen!

Die — wenn man sie so nennen will — »neurochirurgische«

Operation bietet noch einen anderen Vorteil: sie behebt gleichzeitig die Pathologie des uropoetischen Systems. Es ist keineswegs unmöglich, dass diese, wenn sie unbehoben weiterbesteht, — nach Darmoperationen —, auf dem Wege der Urämie die Lebensdauer der Patienten zu verkürzen droht.

Etwas sonderbar berührt die Rekommodation der ausschliesslichen Pharmakotherapie, wenn neben ihr das Bedenken einhergeht, dass Sympathektomie anderen BAUCHorganen schaden könnte. Denn wenn man Parasympathikomimetika anwendet, hat man mit unerwünschten Nebeneffekten zu tun, sogar an Organen ausserhalb des Bauches!

Die sympathische Denervation ermöglicht es auch noch, bereits operative Hilfe bei sehr schlechtem Allgemeinzustand zu bieten, in sehr jugendlichem Alter, wenn Resectio coli kaum erwogen werden kann. Dies wäre sogar in denjenigen extremen Fällen möglich, in welchen man vielleicht für später doch noch an Colonresektion denkt.

Man möge jedoch bedenken, dass das etwaige Übergewicht der Resektionsoperationen keineswegs immer vorhanden ist. Ein Megarektum mit zu resezieren, würde die Kräfte nahezu aller Patienten überschreiten! Somit könnte es noch Sinn haben, beim Rezidiv nach einer Colonresektion dann noch die Sympathektomie zu Hilfe zu rufen.

Viszerale Nachteile, die der Sympathektomie zuzuschreiben wären — ausser der aufgehobenen Ejakulation (dissoziierter Potentionsstörung) als Folge der Resektion des N. praesacralis — sind nicht vorhanden. Dies zeigt sich einestheils aus ihrem Fehlen nach aus der Literatur bekannten hundert Grenzstrangresektionen wegen Kreislaufstörungen, andernteils aus zahllosen Resektionen, die nach CORTE bei weiblichen Personen wegen Dysmenorrhöe stattfinden. Eine eventuelle Läsion parasympathischer Fasern bei Exstirpation des Plexus mesenterius inferior könnte höchstens den Effekt in bezug auf den Darm vereiteln, jedoch keinen weiteren Potentionsverlust irgendwelcher Art herbeiführen. Auch die Chirurgie des Rektumkarzinoms hat unsere diesbezügliche Kenntnis bereichert.

Der Sinn der funktionellen Voruntersuchung ist offenbar dieser, dass festgestellt wird, ob auf eine hypertrophische Muskelwand, die als noch kompensationsfähig zu erachten ist, gerechnet werden kann, falls sie von pathologischen innervatorischen Einflüssen befreit ist.

Mithin würden die groben »verstümmelnden« Operationen an dem Darm selbst (Resektionen) nur noch bei Komplikationen, indiziert bleiben: Volvulus, Perforation oder in eventuellen Fällen die sich nicht durch Sympathektomie besserten, bezw. dazu nicht geeignet schienen.

Mit aus den beiden beschriebenen Fällen möge erhellen, dass kein Grund vorliegt, die »neurochirurgische« Behandlung des Megacolons vorläufig skeptisch, argwöhnisch zu betrachten, da ihr Resultat weniger »tastbar« ist.

Ich will diese Mitteilung nicht beendigen, ohne den sich hierfür interessierenden Leser nochmals auf die vortrefflichen Ausführungen in PÄSSLERS Monographie, die auch im Auszuge die diesbezügliche Literatur enthält, hingewiesen zu haben.

Neuerdings nahm ich die grosse Sympathektomie vor in einem 3. Fall, der mit einem »akuten Bauch« aufgenommen wurde. Die Diagnose Megacolon war auswärts röntgenologisch gestellt, übrigens wäre eine exakte funktionelle Analyse nicht statthaft gewesen. Bei der Laparotomie unter gürtelförmiger Periduralanästhesie fand sich weder Volvulus noch Perforation, nur umschriebene serofibrinöse Unterbauchperitonitis, deren Ätiologie sonst nicht geklärt werden konnte. Grosse Sympathektomie, glatter Verlauf und sehr bedeutsame Besserung wenn auch vielleicht keine vollständige funktionelle Heilung.

Zusammenfassung.

Es wurde eine Auseinandersetzung betreffs der heutigen Ansicht über die funktionelle-(neurogene) Pathogenese der HIRSCHSPRUNGSchen Krankheit, des idiopathischen Megacolons, gegeben. Ferner wurden kurz die Beschwerden und Symptome sowie die chirurgische Seite des Problems besprochen. Die alten (Darmresektions-)Operationen, die auf einer nur scheinbaren morphopathologischen Grundlage fundiert sind, müssen oft neuen Eingriffen an dem sympathischen Nervensystem auf funktionell-pathologischer Grundlage Platz machen; sie setzen die Patienten einem viel geringeren Risiko aus und bieten doch gute Aussichten. Eine funktionelle Colon-Analyse (Metrographie, segmentale Spinalanästhesie, Parasympathikomimetika) dient zur Präzisierung der Indikation. Es wurden zwei durch ausgiebige Sympathektomie geheilte Patienten beschrieben; auf Resektion des »N. praesacralis« darf man sich nicht beschränken. Man muss

diese moderne, recht harmlose Operation nicht solange aufschieben, bis der Allgemeinzustand der dekompensierten Passagestörung die Gefahr ernst vergrößert hat und vielleicht auch die Aussicht auf Erfolg ohne Darmresektion verkleinert, bzw. auf Null reduziert ist.

Summary.

An explanation is given of the conception held at the present day of the functional (neurogenic) pathogenesis of HIRSCHSPRUNG's disease, the idiopathic megacolon. Furthermore the various complaints and symptoms are discussed, together with the surgical aspect of the problem. The intestinal resection operations, formerly in vogue, which were performed upon mere apparent morphopathological grounds, have given place to a new mode of operating upon the sympathetic nervous system. This exposes the patient to much less risk, and yet promises good results. A functional analysis of the colon (metrography, segmental spinal anaesthesia, parasympathicomimetics) is required to furnish exact indications. Two patients, cured by extensive sympathectomy are described; resection of the "N. praesacralis" is not sufficient. The modern, quite innocent operation must not be delayed until the general condition of the patient has seriously deteriorated; decompensation of the intestinal passage aggravates the danger greatly. It may reduce the chance of success without intestinal resection if indeed it does not render it nihil.

Résumé.

L'auteur expose la conception actuelle de la pathogénie fonctionnelle (nerveuse) de la maladie de HIRSCHSPRUNG, le mégacolon idiopathique. De plus il discute des diverses plaintes des malades et des symptômes qu'ils présentent, ainsi que de l'aspect chirurgical du problème. Les opérations de résection intestinale, jadis en vogue, qui étaient entreprises pour des raisons morphologiques purement apparentes, ont cédé la place à une nouvelle tactique consistant à intervenir sur le système nerveux sympathique. Cela expose le malade à beaucoup moins de risques tout en promettant de bons résultats. Une étude fonctionnelle du colon (métrographie, rachianesthésie segmentaire, parasympathicomimétiques) est nécessaire pour poser des indications exactes.

Description du cas de deux malades guéris par sympathectomie étendue; la résection du «nerf présacré» ne suffit pas. L'opération moderne, tout à fait anodine, ne doit pas être renvoyée jusqu'au moment où l'état général du malade est sérieusement touché; la décompensation du transit intestinal aggrave grandement le danger. Pareil retard peut amoindrir les chances de guérir le malade sans lui infliger une résection intestinale, voire réduire ces chances à zéro.

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Pelvic Single Kidney.

Report of a Case

By

JENS VARNEK.

Cases in which there is only one kidney and that in an abnormal situation are a great rarity, which the vast majority of surgeons never encounter. The literature shows that relatively many of these patients have had their only kidney removed with death as the inevitable result. The reason for this is presumably lack of knowledge of the anomaly by the surgeons in question.

As a contribution to this subject, it was therefore decided, at the request of the patient, to submit the following case, in which there was only one kidney, situated to the entrance to the true pelvis.

Case Report.

The patient, a 28-year-old unmarried nulligravida, was hospitalized from January 9 to April 13, 1945. Diagnosis at admission was acute abdominal disorder suspected to be acute appendicitis. In the course of the past months the patient had had two attacks of pain similar to that now experienced. For four hours before admission there had been constant pain in the right iliac fossa radiating to the right loin and accompanied by some nausea and a single attack of vomiting. There was no urinary symptoms. There had been a natural bowel movement two hours before admission. There was no history of abdominal disease.

The patient was moderately well nourished and did not look ill. The temperature was 36.8 C, the pulse 80. Examination of the fauces, heart and lungs (stethoscope), extremities and renal regions showed nothing of note. Palpation of the abdomen revealed distinct tenderness and some muscular rigidity in the right iliac fossa and a tender mass the size of a goose's egg inferior to it.

The external genitals, the vagina and the portio appeared normal. The uterus was of normal shape, size and consistence, and lay pressed

over to the right next to a tender, dense, non-fluctuating, smooth-walled mass nearly the size of a coconut.

The urine was positive for albumen, negative for sugar. Microscopic examination of the urine showed a few white and five or six red blood corpuscles per field of vision. The blood pressure was 130 systolic and 70 diastolic.

Since the pain continued after admission and presumably originated in the mass in the true pelvis (torsion of an ovarian cyst?) medio-inferior exploratory *laparotomy* was done under spinal anesthesia induced with 3 cc. of five percent sol. novocain. eleven hours after admission.

We were surprised to find a tumor opposite the promontory. The mass was situated in the midline, reached slightly down in the true pelvis, measured about 15 cm. broad, 10 cm. high (in the craniocaudal plane) and about 6 cm. thick, and lay with its long axis across the column. It was dense with a convex smooth surface, lay retroperitoneally and was practically immovable.

The uterus was situated obliquely to the right of the tumor. The right tube and ovary were pressed close to the pelvic wall. No adnexa were found on the left.

At first the nature of the tumor was unclear, but it was considered advisable to remove it. The taut peritoneum was opened and partly detached from the anterior and lateral surfaces of the tumor. It was surprising to note how strikingly the exposed tumor surface resembled renal tissue in consistence as well as in colour. The thought occurred to us that perhaps it actually was a kidney, and therefore, in order to be on the safe side, we explored both renal regions and found that there were no kidneys in the normal situation. Greatly relieved that we had not touched the "tumor", we then sutured the peritoneum.

A search was next made for the ureters. From the lower left part of the kidney ran an infiltrated cord as thick as a thumb down to the true pelvis. It was closely adherent to the surrounding tissue and could therefore not be thoroughly palpated. No ureter could be seen issuing from the right side of the kidney.

Before closing the abdominal wall, a pea-sized portion of the "tumor" was removed for biopsy, which showed it to consist of normal renal tissue.

The postoperative course was uneventful. The wound healed in ten days. Though we had not eliminated the cause of the pain (see below), it vanished in three or four days.

In connection with our discovery at the operation, it is of interest that, according to the patient, she had three years previously been operated upon at another hospital for an "internal hemorrhage". From the records, which most kindly were sent us later, it appeared that the patient had been admitted in the same condition as this time. Right-sided pararectal *laparotomy* had been performed under ether. Posteriorly in the true pelvis between the iliac vessels had been felt a tense, elastic tumor the size of a fist, which was movable against the peritoneum and adherent to the anterior aspect of the sacrum. Apparently venous blood had been aspirated with a syringe. It had been assumed

that it would not be possible to remove the tumor. The wound was sutured in three layers. The diagnosis was retroperitoneal hemangioma.

To investigate our queer discovery and to find an explanation of the pain, we later performed cystoscopy and direct and indirect pyelography.

Cystoscopy on January 31 revealed only one ureteral orifice, which was situated in the right side of the bladder.

Pyelography on January 31 and February 15 showed the picture seen in Figure 1. Opposite the center of the sacrum there was a large coarse renal pelvis. Only one ureter could be seen. It issued from the left inferior part of the renal pelvis, crossed the midline of the pelvis and debouched in the right side of the urinary bladder. About 5 cm from the outlet into the bladder the ureter contained a concretion the size of a bean. Opposite the ureter there was a pea-sized shadow, which operation revealed to be a sclerotic gland. Just above the concretion the ureter was greatly dilated. The outlines of the kidney could not be distinguished, but are indicated in the figure.

It was now attempted to remove the concretion endovesically (February 7 and 15) by injection of glycerine, dilation of the ureteral mouth and other means. All attempts failed. It was therefore decided to perform ureterotomy. As this operation was very troublesome and at the same time showed several things of interest, it will be discussed in detail.

There are several methods of removing stones from the lower part of the ureter on record, which have recently been discussed in an excellent short survey by KAERN.

As recommended by KAERN, we chose the paramedial extra-peritoneal incision, which is claimed to have the following advantages over the other methods: slight risk of infection and bleeding and good survey.

On March 3 left-sided *ureterotomy* was performed through a paramedial incision in the right side of the abdomen. The operation was done under spinal anesthesia with 3 cc. of 5 percent sol. novocain, which sufficed for two hours, but for the last half hour had to be supplemented with ether.

Immediately before the operation a No. 4 catheter had been put into the ureter for the sake of orientation. The peritoneum was pushed high up. Dissection was continued bluntly down into the true pelvis, where a good survey was provided. The lateral and posterior walls of the bladder and the corpus and collum of the uterus were easily located. However, the ureter was very difficult to find because of a high grade of periureteritis with adhesions to the surrounding tissue. In spite of a long search, neither the ureteral catheter nor the ureteral stone could be felt. (A hard morsel, the size of a pea, was removed and found to be a sclerotic gland.) An assistant therefore now performed a recto-vaginal exploration. From previous examinations it was expected that the stone could be felt through the vagina (Figure 2). The stone was located and was drawn to the surface of the operative field, where the

operator was then able to feel it. The ureter was cut. A stone the size of a bean was removed in one piece, after which a lot of clear urine welled out. The incision was sutured with four or five catgut stitches. There was only insignificant, oozing bleeding. A tent and a cigarette drain were inserted in the wound, and the abdominal wall was sutured in layers.

The ureteral catheter was removed the day after the operation. For the first two weeks after the operation there was a slight discharge from the wound, but no leakage of urine. At discharge a month later (April 13) the wound was healed and the patient in good condition.

It was learned from the literature that the present anomaly is often associated with anomalies of the sexual organs. We therefore performed *hysterosalpingography* before discharging the patient. No filling of the left tube could be secured (Figure 3). It may be recalled in this connection that no left ovary nor tube could be found during the operation.

Summary. A 28-year-old unmarried woman was admitted for acute abdominal disorder. Laparotomy revealed a "tumor" opposite the promontory and in the true pelvis. It was decided to remove the mass, but then it was discovered that it was the only kidney present. In the ureter was found a concretion, which later was removed by ureterotomy through an incision in the abdominal wall. During this operation valuable help was yielded by a recto-vaginal search for the stone. The patient had neither left tube nor left ovary.

The Embryology of the Kidney.

Several circumstances in the foregoing case will best be understood against the background of the embryology of the kidneys, a brief survey of which will now be given. For details the reader is referred to FISCHEL's and especially to BONNET's and PETER's textbooks of embryology.

The first foundation of the kidney is made by the pronephros. This is very soon replaced by the mesonephros, or wolffian body. When the latter atrophies, the secretion of urine is taken over by the permanent embryonic kidney or the metanephros. All these renal organs are developed from the renal blastema, which lies back of the embryo at each side of the foundation of the column and extends throughout two-thirds of the length of the embryo from the foundation of the lungs to the second sacral segment.

The pronephros is developed opposite the fifth to the tenth segments, the wolffian body, which is by far the largest of the three foundations, opposite the eleventh to the thirtieth primitive

segments, while the permanent kidney is developed far behind and opposite the thirty-first to the thirty-second primitive segments, which correspond with the upper sacral segments.

The outlet system is primarily developed from the pronephros tract, which leads from the pronephros to the cloaca. When the pronephros atrophies, the pronephros tract meets with the wolffian body and is then called the primitive kidney tract.

The permanent kidney is developed from two foundations, the ureteral foundation and the kidney blastema. The ureter is formed as a recess from the primitive renal tract just before the latter issues into the cloaca. The recess grows in a dorsocranial direction into the renal blastema. Here the recess ramifies, so that the renal blastema comes to cover the ends of each branch like a mantle. The ureteral recess with its ramifications form in the permanent kidney the ureter, the renal pelvis, the calyces, the renal papillae and the collecting tubes, while the rest of the kidney, the secretory portion, is developed from the kidney blastema.

The permanent kidney is laid down opposite the second sacral segment. It is then pushed upward and is finally situated opposite the superior lumbar vertebrae, which occurs when the embryo is 12 to 13 mm. in length.

As the ureteral recess grows into the renal blastema in a dorsal direction, the renal pelvis at first comes to lie in front of the kidney. As the kidney moves upward, it rotates 90 degrees, so that the renal pelvis becomes medial to the kidney.

The development of the kidney is intimately connected with the *development of the genital system*. Hence a few words on this subject are indicated. Three foundations are of interest here, namely the genital ridges, the müllerian ducts and the pronephritic ducts.

The genital ridges run as a longitudinal crest at each side of the foundation of the primitive kidney, the mesonephros. From these are developed the sexual glands, the testes and ovaries.

The müllerian ducts, which run alongside the mesonephros, turn in the female into the uterus and tubes, while in the male they atrophy.

The pronephritic ducts in the male turn into the epididymis, the vas deferens and the seminal vesicles, while in the female they atrophy.

The renal and genital anomalies in the case under discussion will now be explained on the basis of the foregoing.

The *absence of the kidney on the one side* can be explained by the failure of one of the permanent embryonic kidneys to develop, or by it soon having atrophied, or by the failure of the kidney to become connected with the cloaca (FORTUNE). The explanation may also lie in defective development of the pronephros duct, a condition observed in serial sections of very small embryos (KORNFELD, quoted by FORTUNE).

The *displacement of the kidney* — in our case opposite the promontory and in the true pelvis — must be explained as due to deficient ascent of the permanent embryonic kidney from the sacral to the lumbar region. The reason for the deficient ascent has been sought in anomalies of the blood vessels of the kidneys, in an abnormal direction of growth of the foundation of the ureter and in abnormal conditions in the true pelvis. A probable explanation, which has been suggested by ectopia of the kidneys in connection with fusion of the two kidneys, is that the branching of the aorta into the two common iliac arteries hinders the ascent, due to the arteries grasping the kidneys as in a fork and so hindering further ascent (WILMER).

As appears from Figure 1, the renal pelvis of our patient was not medial to the kidney, but caudal to it, and may even have been in front of it. This is because the kidney had not ascended so far cranially that its normal rotation had been able to take place, which normally occurs when the kidney has ascended to opposite the middle lumbar vertebrae.

In our patient the *left ovary and tube were missing*. When it is recalled that the ovaries are developed from the genital ridges and that the latter are closely related to the foundations of the kidneys, it is easy to imagine that faulty development of one of the kidneys might be combined with absence of the ovary on the same side. A similar reflection could be made in case of the absence of one of the tubes, because the müllerian ducts, from which the tubes are developed, are also closely related to the foundation of the kidneys.

Previous Cases of Pelvic Single Kidney.

Pelvic single kidney is very rare. STEVENS was only able to gather 25 cases from the literature of more than one hundred years, from 1830 to 1936. To these are added two of his own cases, and in 1940 two more cases were reported (OGDEN and MALTRY,



Figure 1. Direct pyelography. A large, coarse, renal pelvis is seen opposite the middle part of the sacrum. Only one ureter, issuing from the left side of the renal pelvis and debouching into the right side of the urinary bladder, is seen. The existence of only *one* ureter was confirmed by intravenous pyelography. In the ureter can be seen a shadow of a concretion the size of a bean, above which the ureter is greatly dilated. The outlines of the kidney are indicated.



Figure 2. In the right side of the true pelvis two shadows are seen, the lower one of which turned out to be a sclerotic gland, the upper one a concretion in the ureter. This could be felt by vaginal exploration.

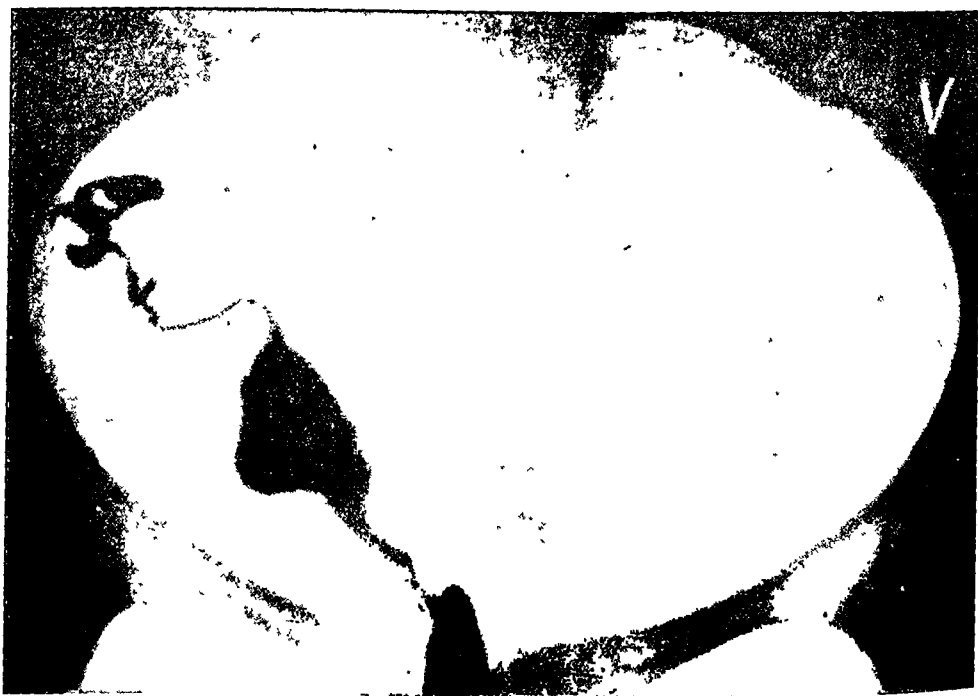


Figure 3. Hysterosalpingographia. No escape of contrast fluid into the left tube is seen.

MAYERS), so that the total number of published cases only amounts to 29. As far as I know, no cases have been published in Scandinavia.

Pelvic single kidney is met with once in every 22,000 autopsies. It should be noted that congenital absence of one kidney- or renal agenesis — according to an extensive statistical study is met with far oftener, namely once in every 700 to 1,610 autopsies (STEVENS).

It may be recalled that our patient had a ureteral concretion. Among the 27 cases of single pelvic kidney published by STEVENS, concretions in the urinary tract were found in not less than three patients. The explanation of the tendency to stones in these patients is probably to be found in the displacement of the kidney, which may complicate the passage of the urine, for instance by an elbow or a sharp bend of the ureter. This was probably the case in our patient (Fig. 1).

The disposition of the displaced kidney to lead to the formation of concretions in the urinary tract is confirmed by examinations by THOMPSON and PACE, who among 97 patients with ectopic kidney, 61 of which were situated in the pelvis, found concretions in not less than seven cases.

In our patient the left ovary and tube were absent. Anomalies of other organs, especially the sexual organs, frequently accompany pelvic single kidney, as well as other kinds of renal anomalies.

In STEVENS'S series of 27 cases of pelvic single kidney 13 (48.1 percent) showed deformity of the sexual organs. Twelve of the 13 patients were females.

In one-sided renal agenesis FORTUNE found genital malformations in 48 (24.2 percent) of 198 males, while THOMPSON and PACE found in 97 patients with renal ectopia 13 (13.4 percent) with anomalies of other organs, among which malformations of both male and female genitals were represented.

The genital malformations observed consisted in females of hypoplasia of the external genitals, atresia of the vagina, septum vaginae, absence of the uterus and tubes, uterus unicornis and uterus bicornis; in males of hypospadias, absence of the seminal vesicles and the vas deferens, as well as cryptorchidism. Anomalies of the sexual glands in the form of hypoplasia or complete absence have also been seen, but more infrequently than the above mentioned anomalies.

In unilateral renal agenesis absence of the left kidney, as in

our patient, seems to be more frequent than absence of the right. Thus, of 387 patients with this anomaly, the left kidney was absent in 218, the right kidney in 179 (FORTUNE).

Regarding sex distribution, STEVENS found 11 females among 16 patients with pelvic single kidney. However, among cases of one-sided renal agenesis, COLLINS found a preponderance of males, namely 281 males and 231 females.

When, as in our patient, the kidney is situated in the entrance to the true pelvis, it is reasonable to assume that it might complicate parturition.

Very little information is available on this point. In the publication in which STEVENS assembled all the cases of pelvic single kidney, this circumstance is not mentioned. Among 286 patients with one fused kidney -- an anomaly often associated with displacement of the kidney -- WILMER found that in only two had there been caesarean section because of the kidney constituting an obstacle to delivery.

Among 97 patients with ectopic kidney, in 61 of whom the kidney was situated in the pelvis, THOMPSON and PACE found 21 females who had given birth. In two of them the child died in connection with instrumental delivery, and in two others caesarean section had to be performed. The authors concluded that the delivery in cases with displaced kidney usually ran a normal course, and they advised waiting to see how labor develops.

Our patient had never borne a child. For safety's sake we advised her in case she became pregnant to enter the hospital in good time before the onset of labor, and we informed her that caesarean section might be necessary.

We now come to an important question, namely the *operative treatment*. This question will be touched on because of the mistakes which in the course of time have been made, and which our patient twice was about to risk.

When a pelvic single kidney gives rise to a situation in which operation is considered, which may happen because of colic due to renal or ureteral stones, acute pyelitis, stasis in the urinary tract due to a bend in the ureter, the picture is often as follows: The patient is admitted suspected of acute abdominal disorder. A mass is found in the true pelvis and regarded as the cause of the disease. Laparotomy is performed, as removal of the "tumor" is contemplated. It is an exceptional surgeon who immediately

when he sees the "tumor" thinks that it might be a pelvic single kidney. There will have been no reason for pyelography before the operation. Under these circumstances it is not surprising if the "tumor" is removed and the surgeon does not discover until afterwards that the mass in reality was a kidney, perhaps the only one.

Among 27 cases of pelvic single kidney, STEVENS found that two patients — both twentyone years old — underwent nephrectomy, which naturally resulted in anuria and death. The same fate struck ten of 422 patients with one-sided renal agenesis (FORTUNE) and five of 286 patients with one fused kidney (WILMER).

It is highly probable that during the course of the years more cases have actually occurred than are mentioned in the foregoing. Not everyone has the courage to publish his mistakes, even if they might prevent others from repeating the error.

Summary.

A report is given of a case of pelvic single kidney, of which only 29 cases seem to have been published up until 1940.

The diagnosis in this case was established by laparotomy, which revealed a cake-like kidney in the midline opposite the promontory and the upper part of the true pelvis. The left ovary and tube were missing. The patient also had a ureteral stone, which was removed through a paramedial laparotomy on the right side, this incision allowing entrance to the lower part of the ureter in the true pelvis.

To understand certain discoveries in the case under discussion, the embryology of the kidneys and sexual organs is briefly reviewed.

The frequency of this renal anomaly, its tendency to lead to concretions in the urinary tract and the occurrence of concurrent anomalies of the other organs are surveyed on the basis of the literature. In the same connection it is stated that pelvic single kidney might constitute an obstacle to childbirth.

Our patient twice ran the risk of having her only kidney removed, the first time at another hospital, where the kidney was thought to be a retroperitoneal hemangioma, which was not removed only because extirpation was regarded as technically impossible; on the second occasion the surgeon discovered the mistake just in time — as he was about to ligate the kidney stalk.

According to the literature, 17 of 735 patients with only one kidney, which in some was abnormally placed, have been submitted to nephrectomy with anuria and death as a result.

Although the renal anomaly described is rare, knowledge of it is therefore important to those who perform abdominal surgery.

Zusammenfassung.

Es wird ein Fall von solitärer Beckenniere mitgeteilt, von welcher wie es scheint bis 1940 nur 29 Fälle veröffentlicht worden sind.

Die Diagnose wurde bei unserer Patientin bei Laparotomi festgestellt, wobei eine in der Mitte liegende platte Niere in der Höhe von Promontorium und in dem oberen Teil des kleinen Beckens gefunden wurde. Der linke Eierstock und Eileiter fehlten. Die Patientin hatte gleichzeitig einen Harnstein, welcher entfernt wurde, indem man durch eine rechtsseitige paramediane Laparotomie sich Zutritt bis zum tiefsten Teil vom Harnleiter in dem kleinen Becken erreichen konnte.

Zur Erläuterung von gewissen Befund bei der Patientin wird kurz die Entwicklung der Nieren und der Geschlechtsorgane hervorge stellt.

Die Häufigkeit der solitären Beckennieren samt ihrer Neigung zur Bildung von Nierenkonkrementen sowie das gleichzeitige Auftreten von Anomalien in anderen Organen werden auf Grund der Literatur besprochen. In demselben Zusammenhang wird mitgeteilt, dass die solitäre Beckenniere als ein Geburtshindernis auftreten kann.

Unsere Patientin war zweimal dafür ausgesetzt ihre einzige Niere entfernt zu bekommen, das erste Mal in einem anderen Krankenhaus, wo man während der Operation die Niere als ein retroperitoneales Haemangiom auffasste, die man unterliess zu entfernen nur deshalb, weil der Eingriff als technisch unmöglich angesehen wurde — das zweite Mal während des gegenwärtigen Krankenhausaufenthalts, wo man anfang die Niere zu entfernen, aber frühzeitig genug — vor die Unterbindung des Nierenstiels — den Fehlgriff entdeckte.

Infolge der Literatur sind 17 von 735 Patienten mit nur einer Niere, wovon ein Teil abnorm gelagert war, nephrectomiert worden mit Anurie und tödlichem Ausgang zur Folge.

Obgleich die beschriebene Nierenanomalie selten ist, ist das Kenntnis davon deshalb wichtig bei dem Chirurgen, der sich mit der abdominalen Chirurgie beschäftigt.

Résumé.

On va faire part d'un cas solitaire rein de pelvis. Jusqu'à 1940 29 résultats en ont été publiés.

La diagnose a été faite chez la malade par laparotomie. Au milieu on trouve le rein plat dans l'hauteur du promontoire, dans la partie au dessus du petit pelvis. L'ovaire gauche et la tubaire manquaient. La malade avait, en même temps, une pierre d'uretère qu'on avait enlevée par laparotomie paramédiane du côté droit; on cherchait le chemin pour y arriver dans la partie la plus profonde d'uretère jusqu'au le petit pelvis.

Pour faire comprendre certaines constatations chez la malade l'embryologie des reins et des organes génitaux sera présentée et marquée.

La fréquence des reins solitaires bassin, leurs dispositions pour avoir des concrémments dans les organes urinaires et l'apparition simultanée d'anomalies des autres organes sont discutés, l'auteur se reposant sur la littérature. Dans le contexte on dirait que le rein solitaire pelvis pourrait être un obstacle d'accouchement.

La malade se trouva deux fois en danger d'avoir son seul rein enlevé — la première fois dans un autre hôpital où, pendant l'opération laparotomie, on a pris le rein pour un haemangiome retropéritoneal qu'on n'a pas enlevé seulement parce que l'extirpation était considérée comme impossible au point de vue technique. La deuxième fois cependant, on a, pendant son séjour à l'hôpital, commencé de lui enlever le rein, mais assez tôt — avant de faire la ligature des vaisseaux rénaux — on a découvert l'erreur fatale.

Par suite de littérature 17 de 735 malades qui n'avaient qu'un rein et qui, en partie, étaient ectopics ont été nephrectomés, ce qui résultait en anurie et exitus letalis.

Bien que l'anomalie du rein décrite soit vraiment rare la connaissance en est très importante pour le chirurgien qui s'occupe avec la chirurgie abdominale.

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From the University Clinic, Surgical Department B., of Oslo.
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Carcinoma of the Oesophagus, Thoracic Part, Excision, Operative Cure.

By

R. INGEBRIGTSEN,

Oslo.

The radiological treatment of carcinoma of the oesophagus has not produced encouraging results, and as far as I am aware, neither has the high voltage treatment of these tumours instituted in this country made the prospects any brighter. Whether experiences to the contrary have been reaped in other countries during the war I do not know.

When a malignant growth in the thoracic part of the oesophagus is localized high up, and the extirpation of the tumour in some cases necessitates the removal of the entire oesophagus, it is quite natural, that several of these patients refuse such a mutilating intervention, which besides also involves a great operative risk. There are not many who accept the proposition. The majority of these unfortunate patients still desire to try irradiation treatment.

My patient is a 68-year-old man, who was admitted into the Surgical Department B. of the University Clinic of June 9th 1944. 2—3 months before admission he suddenly noticed a sensation of boring pain behind the breast bone. He had to gulp up the food he had just swallowed, which was admixed with some viscous mucus. No ructus and pyrosis. The gulping up of the food was followed by complete relief from pain. Later the patient has complained of daily similar attacks with exacerbation. The last days he has only been able to swallow liquid food, and he is obliged to drink very slowly. He is always hungry, has felt lax and depressed, and has lost weight, without having controlled this by weighing. He considers, that in the past 2—3 months he has eaten only one-third of the quantity he needed.

On admission the patient was lean. Blood pressure 130/70. Physical examination of heart and lungs negative. Weight on admission 56.3 kilogrammes. Hemoglobin 98 per cent. Red corpuscles 4.6 millions. Sedimentation rate 54 mm. Urine negative. *X-ray examination* of the oesophagus: Above the cardia is observed an oesophageal obstruction approximately 7 cm long, typical of carcinoma. Even thin opaque medium stops up to some degree above the obstruction. Thicker opaque medium stops up to a greater degree and fills a considerable dilatation of the lumen above the obstruction.

On June 14th a *gastrostomy* was carried out under local anaesthesia.

On July 3rd the operation on the oesophagus was performed. The thoracic wall was anaesthetized locally, and the patient kept under nitrous oxygen with positive pressure. The patient was put in right lateral position and the seventh rib resected subperiosteally. No adhesions between the lung and the thoracic wall. The mediastinal pleura was incised above the diaphragm. Below the tumour a thin rubber tube was passed round the oesophagus in order to present it with the tumour by blunt dissection. This was performed without injury to the right pleura. In the upper level of the tumour the adhesions were rather tough and had to be cut through; a slight hemorrhage occurred, which was arrested by compression. Above the tumour the dissection was continued as high up as possible, without complications.

A fresh incision was placed on the left side of the neck at the anterior border of the sternocleidomastoid muscle. The oesophagus was identified and freed from above downwards in the mediastinum, until the fingers of my right hand from above met those of my left hand from below.

3—4 cm below the lower limit of the tumour the oesophagus was doubly ligated after having been crushed and cut through between the ligatures. The lower stump was inverted downwards, and disappeared. The upper stump was inverted in the same manner, and carefully sewn over.

I now returned to the neck and was able to bring the thoracic part of the oesophagus with the tumour up through the mediastinum, and out through the wound in the neck. Another incision was made just above the left clavicle, and from this incision a subcutaneous canal was made upwards to the first incision, sufficiently wide to permit the passage of the tumour, which now was brought out through the last incision; the oesophageal wall well above the upper level of the tumour was fixed to the skin edges of the last incision. The upper wound in the neck was closed. After inflation of the lung by increasing the pressure of the apparatus, the thoracic wound was completely closed. Thoracic drainage with permanent aspiration was established through a Pezzer catheter introduced through an extra intercostal incision in the bottom of the pleural cavity. The condition of the patient was very satisfactory at the end of the operation — pulse rate 80. The bleeding had been insignificant, and the postoperative course was uneventful, as seen by the accompanying chart. In the afternoon the pressure was 100/70, and he was given a blood transfusion. The



Fig. 1.

INGEBRIGTSEN: Carcinoma of the Oesophagus.

Pezzer catheter was removed four days after the operation. Next day — twenty-four hours later — a small pleural exudate was removed by puncture. The culture proved sterile.

The wounds in the neck and chest healed by first intention.

The oesophagus was cut through and the tumour removed one week after the operation.

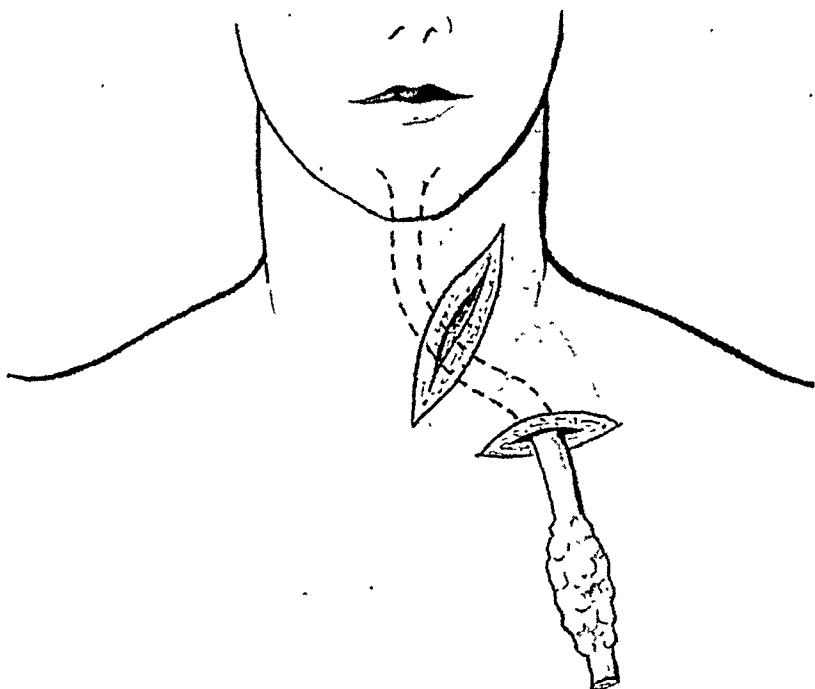


Fig. 2.

Histological examination of the tumour disclosed typical flat epithelium carcinoma. The subsequent course was uncomplicated, and the patient was allowed out of bed 24 days after the operation. He had then commenced eating in natural manner, the opening of the oesophagus being connected with the gastric fistula by a rubber tube. His weight before the oesophagus resection was 51 kilogrammes, decreasing slowly until 14 weeks after the operation it was 50 kilogrammes. Some small difficulties arose with the oesophageal opening on the neck, where shrinking occurred, necessitating minor plastic interventions. The patient did not find the new mode of living easy. Before admission he was inmate of a home for old people, where it was not possible to accomodate him again due to the difficult time of food rationing, so that he had to stay on for the time being in the department. The last time he was weighed, 5 months after the operation, the weight was 45.5 kilogrammes. From now on he became gradually more depressed, did not feel like eating, and became completely bedridden, without any other explanation being found of this than inanition. No mechanical



Fig. 3. Photograph of the patient 4 months after the operation.

hindrance of the swallowing was found, however. He died 6 months after the operation.

Autopsy revealed oedematous lungs and total adhesions on the posterior and lateral surfaces of the left lung. In the mediastinum no morbid changes were observed, especially no glands with cancerous infiltration.

On inspection of the lower stump of the oesophagus, which was inverted towards the cardia, no macroscopical tumour growth was visible. Histologic examination, however, of the lower resection edge demonstrated cancerous infiltration. The cause of death, therefore, must be given as inanition, pulmonary oedema, and incipient bronchopneumonia.

The patient concerned is not the first I have operated on by this method, but he is the first case of operative cure. The method used is the same as the one proposed and carried out successfully by FRANTZ TOREK in 1913. The patient of TOREK lived happily with her rubber tube for 14 years. The method has been used also by several other surgeons in the course of 30 years, thus by EGGERS (New York), GREY-TURNER and TUDOR EDWARDS (London), HEDBLOM (Chicago). A couple of years ago BALLIVET collected from the literature 24 cases of operative cure.

The treatment of carcinoma of the oesophagus — as in the case with all cancer therapy — depends more than anything else on an early diagnosis. In this respect the localization to the oesophagus is extremely unfavourable, because this resilient organ allows the passage of food without embarrassing swallowing difficulties, even if the tumour is far advanced. The operability is small — between 10 and 16 per cent. Unfortunately it is not infrequent that the thoracic cavity has to be opened and the mediastinum palpated to decide whether or not the tumour is operable. Indeed, in some cases this is only revealed after the mobilization of the tumour has commenced. In my opinion the presence of hard cancerous glands in the mediastinum is a contraindication against attempt at extirpation.

Summary.

The author relates a case of cancer of the oesophagus, thoracic section. After a preliminary gastrostomy the gullet with the growth was removed by way of an open thoracotomy (resection of 7th rib), the upper end of the cut oesophagus was brought out to the skin above the clavicle and connected with the gastrostomy by a rubber tube. He lived for 6 months and died from broncho-pneumonia (autopsy).

Zusammenfassung.

Der Verfasser berichtet einen Fall von Cancer in Brustteil der Speiseröhre. Nach Gastrostomie wurde die Speiseröhre mit dem Geschwulst durch offene Thoracotomie entfernt, die obere Ende der durchgeschnittenen Speiseröhre an die Haut über dem Schlüsselbein genäht, und mit der Gastrostomie durch einen

Gummischlauch verbunden. Der Mann lebte 6 Monate nach der Radikaloperation und starb durch Lungenentzündung.

Résumé.

Compte rendu d'un cas de cancer de l'ésophage thoracique. Après l'opération d'un gastrostomie l'ésophage avec la tumeur était exstirpé par voie thoracique, le bout supérieur de l'ésophage coupé abouché à la peau au dessus de la clavicule, et un tuyau de caoutchouc assura la communication avec l'estomac par la gastrostomie. Il a vécu pendant 6 mois après l'opération, mourut alors de congestion pulmonaire.

From the University Institute of Forensic Medicine, Copenhagen.
(Chief: Professor KNUD SAND, M. D.)

Fertility in Operatively Treated and Untreated Cryptorchism.

By

T. SVEND HANSEN.

In 1925 WILLIAMS & SAVAGE demonstrated a correlation between the occurrence of abnormally formed spermatozoa in the ejaculates of bulls and their fertility; this finding was the signal for numerous investigations of a similar kind on human subjects [lit. MOENCH (7,8), WEISMANN (10), JOËL (5), LANE-ROBERTS et al. (6), HAMMEN (2), VARNEK (9), and others], and it is now generally agreed that on the basis of sperm investigations it is possible to form an estimate of the presumable fertility of a man.

The object of the present work has been *to investigate the fertility of men with operatively treated and untreated cryptorchism by means of sperm examinations carried out by modern methods.*

The technique adopted by the sperm examinations is shortly as follows: the amount of the ejaculate being measured the percentual number of motile spermatozoa is determined and after a suitable dilution of the ejaculate the number of spermatozoa per cc and in the total ejaculate is counted. The number of abnormal spermheads is determined in stained smears of the undiluted specimen.

According to the results emerging from the sperm examinations the presumed impairment of fertility of the subjects examined was classified in following way, as used at the Institute of Forensic Medicine:

The designation *slight impairment of fertility* was applied to the cases showing

- 1) abnormal heads: 21—30 % or
- 2) spermatozoa count per cc: 15—40 millions, or
- 3) amount of ejaculate: 1—1.5 cc, or
- 4) slight changes in motility.

A *moderate impairment of fertility* was presumed in the cases showing

- 1) abnormal heads: 31—40 % or
- 2) spermatozoa count per cc: 5—15 millions, or
- 3) amount of ejaculate: 0.5—1 cc or
- 4) moderate changes in motility.

The designation *severe impairment of fertility* was applied to the cases showing

- 1) abnormal heads: 41 % or more or
- 2) spermatozoa count per cc: under 5 millions, or
- 3) amount of ejaculate: under 0.5 cc or
- 4) pronounced changes in motility.

Finally the designation *sterility* has been applied to those cases in which no spermatozoa were found either in fresh samples of the ejaculate or in stained smears of centrifuged ejaculate after half an hour's centrifuging of the ejaculate.

In the estimates the various parts of the sperm examinations have been taken into consideration so that if great deviations from the normal were found on several points in the same sperm sample, the degree of impairment was increased, the percentage frequency of abnormal heads, the spermatozoa count, and the amount of the ejaculate being in the first place considered.

The material of patients examined comprises a total of 124 men divided into the following groups:

- "A": bilateral cryptorchism, untreated, 9 patients.
(examination of sperm from 9 patients).
- "B": bilateral cryptorchism treated with orchidopexy, 30 patients
(examination of sperm from 52 patients).
- "C": unilateral cryptorchism treated with orchidopexy, 43 patients
(examination of sperm from 36 patients).
- "D": unilateral cryptorchism, untreated, 42 patients.
(examination of sperm from 35 patients).

Examination of the sperm from the 9 patients of material "A", whose testes were in all cases situated in the abdomen or the inguina, showed aspermia in all cases, corresponding to the findings of numerous other investigators; which shows that in this

position the testes may be assumed not to contain spermiogenic tissue.

Material "B" comprises patients who have undergone the following forms of operative treatment:

- 1) *bilateral orchidopexy*: 22 patients
- 2) *unilateral orchidopexy*, while the other testis is
 - a) situated in the abdomen or high up in the inguina: 4 patients
 - b) removed by operation: 1 patient
 - c) placed intraperitoneally by operation: 3 patients.

Hence the group comprises a total of 30 cases of bilateral cryptorchism in which it has been attempted to bring down either one or both the testes into their normal place in the scrotum. In those cases in which only unilateral orchidopexy was performed, the other testis had either been removed or it was situated in such a place that it could be assumed not to contain spermiogenic tissue.

By examining the sperm from these men it will therefore be possible to ascertain the spermiogenetic function in the testes treated with orchidopexy, though it must be kept in mind that it cannot be determined by the examination of the sperm whether a possible aspermia may be due to the destruction of the spermiogenic tissue in the testes or whether spermatozoa are produced which owing to occlusion of the efferent seminiferous ducts are not voided at the ejaculation. For the estimation of the fertility this question is, however, of no significance, since patients with aspermia are sterile no matter what the cause of the aspermia. Whether a demonstrated aspermia is of one or the other origin can only be decided with certainty by a histological examination of testicular tissue removed by biopsy.

The objective examination of the testes showed that of the 52 operated testes, there were only 11 in which the result could be regarded as anatomically normal, while in the remaining 41, greater or smaller deviations from the normal could be pointed out, either as regards the size or the position or the consistency, or several of these deviations at the same time. In 3 patients total atrophy of both testes was present with a consequent defective development of the patient.

Examination of the sperm from 25 patients was made. Of the chief results of these examinations the following may be mentioned:

The spermatozoa count per cc showed:

aspermia	14 cases
less than 1 million per cc	2 »
1—10 millions per cc	2 »
10—50 millions per cc	7 »

The total spermatozoa count showed

less than 50 millions	6 »
50—250 millions	5 »

The differential count of stained smears showed

20 % or less of abnormal heads	5 cases
21—30 % » » » »	1 case
31—80 % » » » »	4 cases

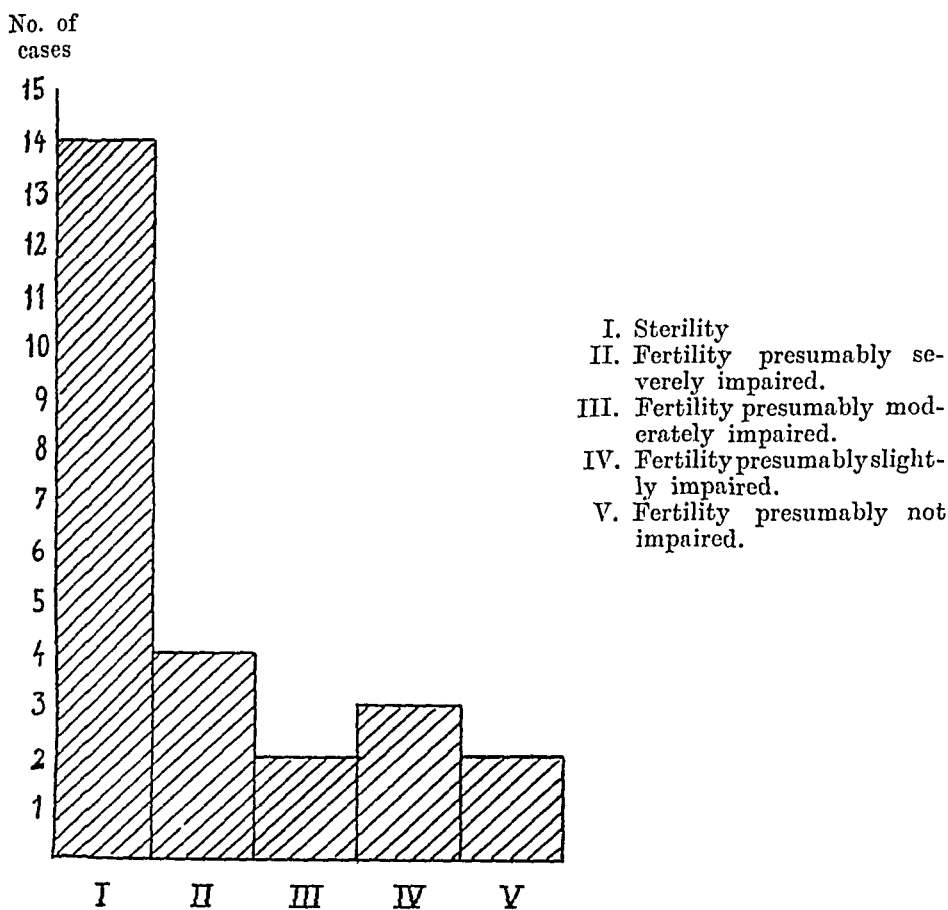
(in one case the number of spermatozoa was too small for a differential count).

The results of the fertility estimates on the basis of the sperm examination carried out on the lines previously indicated are given in Curve 1.

As will appear from this curve, the result of the treatment with orchidopexy has in most cases been a complete arrest of fertility manifesting itself as aspermia, while in two cases only it was not possible to show any impairment of fertility. In the other cases conditions were such that a more or less marked impairment of the fertility must be supposed to be present, and none of the ejaculates attained the normal average values recorded in the literature in all respects.

If we examine the relation between the size, consistency and position of the operated testes, that is to say, the anatomical result of the operation and the results of the sperm examinations, it turns that aspermia has been found in those cases in which all the three characters deviate from the normal in both testes. Further, as was to be expected, aspermia was found in those cases in which there was retraction of both the operated testes to the neighbourhood of the inguinal canals.

In those cases in which normal conditions were found in at least one testis with respect to the above-mentioned characters, this was, except in one instance, combined with the occurrence of sperm in the ejaculate from the patient in question. On the other hand, it was not possible in these cases to demonstrate any relation between the anatomical condition of the testes and the degree of fertility, since the examination of sperm from these pa-



Curve I.

Results of the fertility estimates in patients treated with orchidopexy for bilateral cryptorchism.

tients showed both normal conditions and signs of all degrees of impaired fertility.

Softness of the testes seems to indicate the severest lesions, this condition having only been found once coincidentally with spermatozoa in the ejaculate, and the fertility must in this case be assumed to be severely impaired; while softness of the testes as the chief deviation from the normal was combined with aspermia in 4 cases.

In 3 cases, in which one or both testes were of normal consistency and size, but in which they were situated in the middle of or high up in the scrotum, spermatozoa was found in the ejaculate in all cases. In these cases the fertility was impaired in slight and severe degree respectively, and in one case probably not impaired.

If we compare the results of the fertility estimates with the

results published in the literature concerning the anatomical effect of the treatment with orchidopexy — and it is on this that the estimations of the effect of the operation are usually based — it turns out that the fertility estimates give a considerably gloomier outlook than the other method of estimation.

If we sum up in their broad features the results recorded in the literature it will be seen that about 60 % of successful results, about 30 % of poor results, and about 10 % of total atrophy of the operated testes is usually the outcome anticipated. If, on the other hand, the estimates are based on the sperm examinations, in most cases, as already shown, the desired result of making the testes produce spermatocytes is not obtained, and in the cases where this is achieved both the quality and the quantity of the spermatozoa is as a rule poorer than normal.

Material "C" comprises 43 patients treated with orchidopexy owing to unilateral cryptorchism.

In 41 patients the normally descended testis was normal with respect to size, position and consistency, while in 2 cases it was softer than normal. The operated testis was only in three cases such that no deviation from the normal could be pointed out, that is to say, there was complete identity between the operated and the unoperated testis.

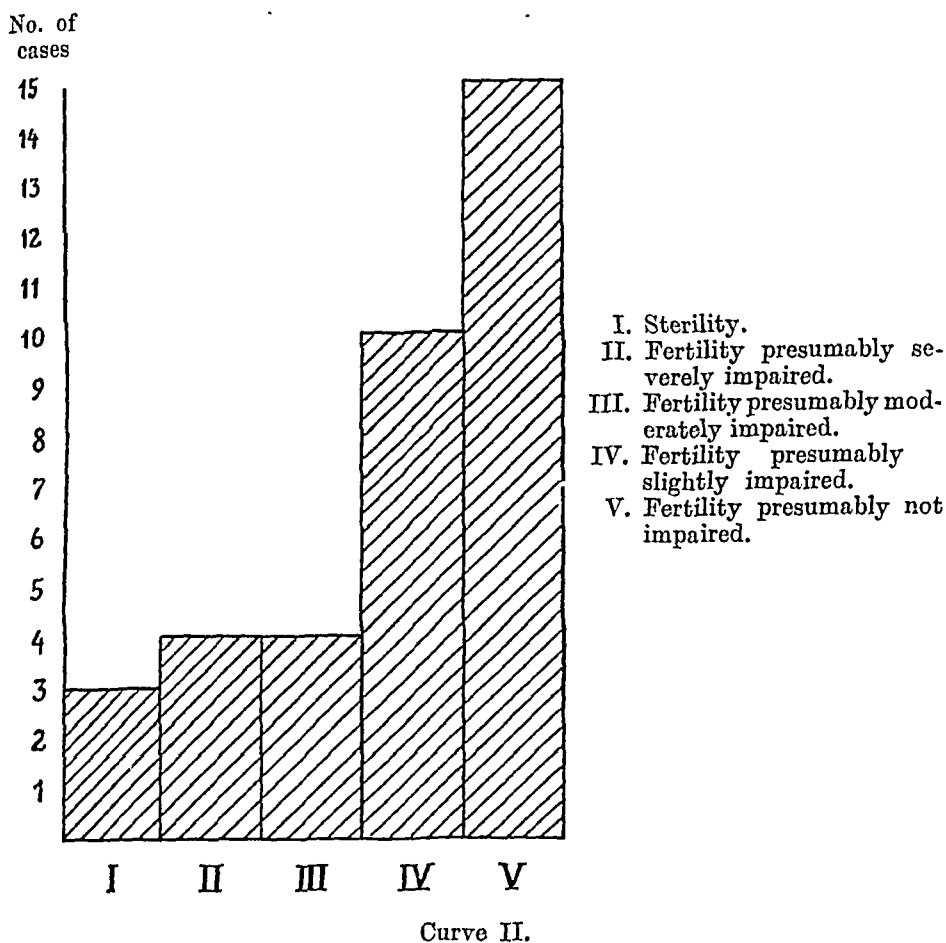
Examination of the sperm from 36 patients is available, the chief results being as follows:

Spermatozoa count per cc:

Aspermia	3 cases
20 millions or less per cc	3 »
21— 60 millions per cc	12 »
61—100 » » »	9 »
101—140 » » »	5 »
141—180 » » »	1 »
181—220 » » »	3 »

Total spermatozoa count (in one case part of the ejaculate had been lost so that no total number can be given).

50 millions or less	5 cases
51—150 millions	10 »
151—250 » 	6 »
251—350 » 	6 »
351—450 » 	1 »
over 451 » 	4 »



Results of fertility estimates in patients treated with orchidopexy for unilateral cryptorchism.

Differential count:

20 % or under of abnormal heads	19 cases
21—30 % » » »	9 »
31—40 % » » »	2 »
41—67½ % » » »	3 »

The results of the fertility estimates are plotted in Curve 2.

As will appear from this curve, the fertility must in by far the greatest number of cases be supposed to be normal or slightly impaired, while only few cases show such conditions at the examination of the sperm that the fertility must be supposed to be essentially impaired.

The three cases of aspermia require further discussion, such cases of aspermia having in the literature been made to subserve

the view that the descended testis shows a defective spermiogenesis owing to the same inhibitory malformation as was manifested in the unilateral retention of the testis.

In one of the patients biopsy was performed both on the normally descended testis and on the operated originally retained testis, and in both instances a histological examination showed testis tissue with fully developed spermiogenesis, so that the aspermia present must be due to obstruction in the efferent seminiferous ducts, as could indeed be shown at an epididymo-vasostomy and vasotomy performed later, with negative results.

In the other patient with aspermia biopsy of the normally descended testis — the operated testis was completely atrophied — showed normal testis tissue in lively spermiogenesis, so that the aspermia in this case, too, was due to an obstruction of the passage, probably caused by a gonorrheal infection 10 years prior to the examination.

The third patient did not want biopsy performed.

It is seen that no correlation can be demonstrated between the results of a sperm examination and the anatomical result of the operation. The conclusions which may otherwise be drawn will be discussed in connection with the results of the examination of material "D".

Material "D" comprises 42 patients and consists of

1) patients whose cryptorchism has not been treated, and in whom the retained testis is situated abdominally or high up in the inguina (30 patients).

2) Patients in whom the retained testis has been removed or placed intraperitoneally by operation (12 patients).

A characteristic of all the patients in this group is that one testis has always been situated in its normal place in the scrotum, while the cryptorchic testis has either been removed or is situated in such a place that it does not take part in the production of spermatozoa.

Hence by examining the sperm from these patients we get a material which shows what the sperm production is in men who only possess one testis placed in such a position that there is a possibility that it may produce spermatozoa.

By comparing the results of the sperm examinations from the patients in this group with the patients treated with orchidopexy for unilateral cryptorchism, it will be possible to ascertain whether there is any difference in the sperm production in the untreated

and the treated unilaterally cryptorchic men, that is to say, any effect of the operation.

In 2 patients the descended testis was of soft consistency, while in the others it was normal both in size, position, and consistency.

Examinations of sperm from 35 patients are available. *The spermatozoa count per cc*, was found to be as follows (owing to a technical mishap only so little remained from one ejaculate that it was impossible to make any count):

aspermia	1 case
20 millions or less per cc	4 cases
21—60 millions per cc	10 "
61—100 " " "	10 "
101—140 " " "	9 "

The total spermatozoa count showed the following values:

50 millions or less	4 cases
51—150 millions	11 "
151—250 " "	8 "
251—350 " "	6 "
351—450 " "	1 "
over 451 " "	3 "

The differential count showed

20 % or less of abnormal heads	15 cases
21—30 % " "	10 "
31—40 % " "	3 "
41—70 % " "	6 "

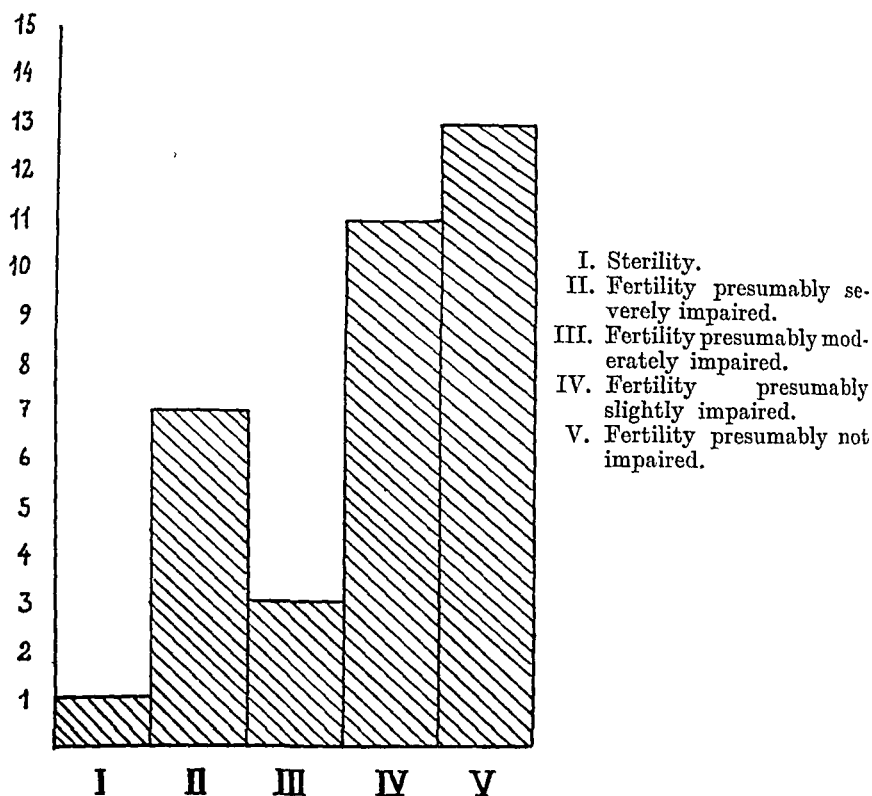
The results of the fertility estimates are plotted in Curve 3.

As will appear from the curve, the fertility must in most of the cases be assumed to be normal or slightly impaired, while few show signs of a more pronounced impairment of fertility.

One patient, who had aspermia, gave a past history of several severe infections, amongst others "Spanish flue" and syphilis, so it may be supposed that these infections have caused the destruction of the spermiogenic tissue in the testis, and that this bears no relation to the unilateral testis retention. No testicular biopsy was performed.

Comparison of materials "C" and "D".

As previously mentioned, the object of examining the patients in material "D" was to ascertain what the sperm production and fertility was in men who had only one normally descended testis,

No. of
case

Curve 3.

Results of the fertility estimates in patients with untreated unilateral cryptorchism.

and thus to procure a material comparable with that obtained from the examination of patients whose unilateral cryptorchism had been treated with orchidopexy (material "C"). Since the two groups of patients do not otherwise differ from each other it must be supposed that the differences that may perhaps be demonstrated in the results of the examinations are due to the operative treatment to which the patients in material "C" have been subjected.

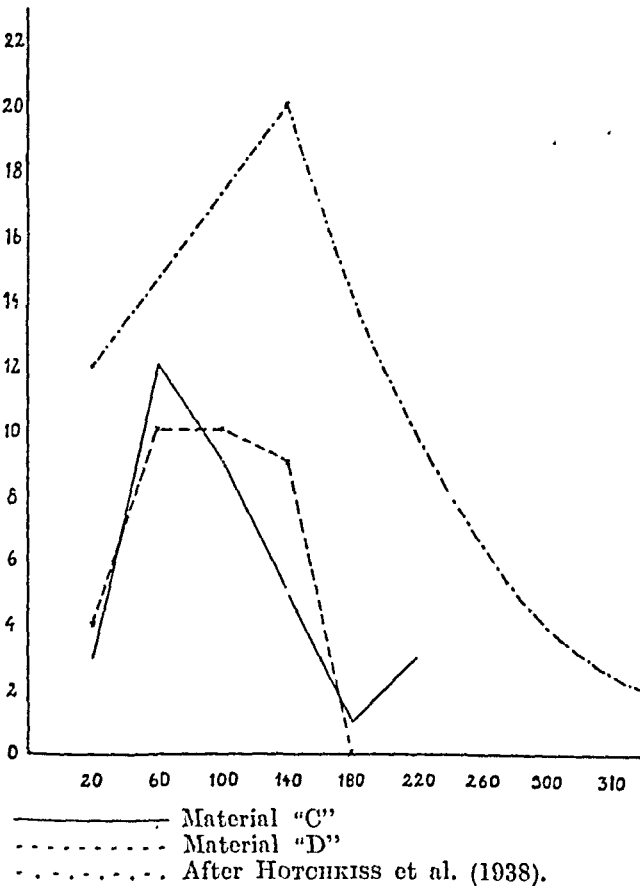
Some of the results of the sperm examinations from the two groups of patients are set forth in Table 1.

The results of the spermatozoa counts per cc and the total spermatozoa count for materials "C" and "D" are plotted in Curves 4 and 5. These curves also shown after HORTCHKISS *et al.* (4), the results which the authors have given for the corresponding

Table 1.

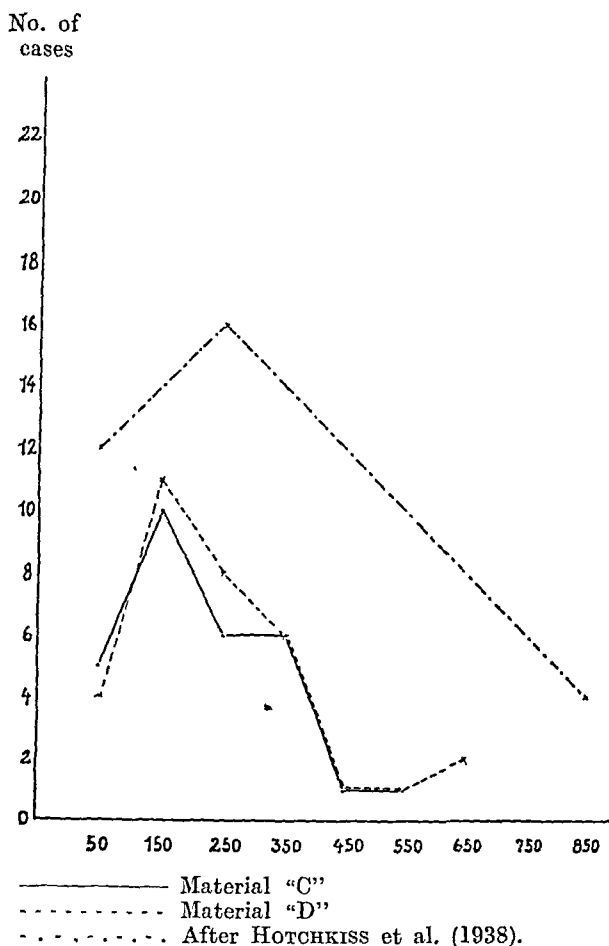
	"C"	"D"
Volume average	0.7—6.8 cc. 3.1 cc.	0.6—7.0 cc. 3.1 cc.
Immobile spermatozoa average	13—88 % 39.2 %	20½—81 cc. 46.5 %
Immature spermatozoa average	3—55 % 19.9 %	3—33 % 14.7 %
Abnormal heads		
20 % and less	19 cases	15 cases
21—30 %	9 "	10 "
31—40 %	2 "	3 "
41—70 %	3 "	6 "
Fertility		
presumably normal	15 cases	13 cases
" slightly imp.	10 "	11 "
" moderately "	4 "	3 "
" severely "	4 "	7 "

No. of
cases



Curve 4.

Curves of the spermatozoa count per cc. from materials "C" and "D" and after HORTCHISS et al. (1938).



Curve 5.

Curves of the total spermatozoa count in materials "C" and "D" and after Hotchkiss et al. (1938).

examinations of ejaculates produced by masturbation of fertile men, since this material must be assumed to represent the values to be found upon examination of sperm from normally fertile men with two normally placed testes.

Finally Table 2 shows the lowest value, the highest value, and the average value of the number of spermatozoa per cc and of the total spermatozoa count partly from materials "C" and "D", and partly the corresponding values after Hotchkiss *et al.*

If we compare the results of the examinations of materials "C" and "D" it turns out that both the separate parts of the sperm examinations and the conclusions concerning the fertility of the subjects in question must be regarded as very nearly

Table 2.

	Spermatozoa count per cc. (in millions)			Total spermatozoa count (in millions)		
	lowest	highest	average	lowest	highest	average
"C"	4.4	214.7	77.8	10.1	974.2	232.4
"D"	0.5	139.7	63.1	2.0	611.1	186.1
HOTCHKISS <i>et al.</i> ..	4.7	466.0	137.54	2.82	2330.0	429.68

identical, the differences found between the two materials being so small that no importance can probably be attached to them. Thus it is seen that the curves of the spermatozoa count per cc and for the whole of the ejaculate partly have the same form and partly have peaks at about the same value.

The identity demonstrated between material "C" and "D" must then be supposed to be due to the fact that it has not been possible, by means of the operative treatment of the testis retention in material "C", to make the originally retained testis produce so many spermatozoa that it has been able to affect the average values, and that, altogether, these patients only produce spermatozoa with the normally descended testis and so present the same conditions as the patients of material "D" in whom we can take it for granted that only the normally descended testis is sperm-producing.

If next my curves are compared with those of HOTCHKISS *et al.* it will be seen that all the curves have very nearly the same form, but the peaks of these authors' curves are in both case displaced to the right and correspond to values about twice as high as in my materials.

The fact that the values found from HOTCHKISS *et al.* for the spermatozoa count are almost exactly double the values found by me in materials "C" and "D" is seen even more plainly from Table 2, the average values for my materials both as regards the spermatozoa count per cc and the total spermatozoa count being very nearly half of the values given by HOTCHKISS *et al.*

Since the same technique has been used at the counts and since this technique is very simple and not dependent on a subjective estimate, it may be assumed that the results are directly comparable; hence it is no doubt allowable to assume that the difference between HOTCHKISS *and co-workers'* material and my material "C" and "D" is that the number in my material is

half that of the material of HOTCHKISS *and co-workers*. Since the difference consists in the sperm material of HOTCHKISS *et al.* being derived from men who must be assumed to possess two normal testes, while my material is derived from patients who have only one normally descended testis, the difference in the results must be supposed to be due to the fact *that men with two testes produce on an average twice the amount of spermatozoa as men with only one testis*.

The examinations of sperm from patients in material "C" therefore point in the same direction as the examinations of sperm from patients only possessing testis which owing to retention had been treated with orchidopexy (material "B"), since it appeared from these investigations that in most cases there were few or no spermatozoa in the ejaculate of these patients.

The examinations of sperm from the patients in materials "C" and "D" shown, in addition, that the normally descended testis as regards sperm production must be regarded as just as capable of functioning as each of the testes in men with normally descended testes.

Both the information as to the clinical fertility and the fertility estimates based on the sperm examinations show that the one normally descended testis produces normal spermatozoa in sufficient number for these men to be regarded as just as fertile as normal men. Owing to the fact, however, that most of these patients only have one testis which produces essential numbers of spermatozoa since the operated testes, as already mentioned, probably only produce normal spermatozoa in small number, these patients, however, lack the surplus found in normal men whose testes both take part in the sperm production. Hence affections which have an injurious effect on the germinative testicular tissue, *e. g.* severe infections and other toxic affections, may have more serious consequences for these patients as regards fertility than in normal subjects, since the number of spermatozoa in unilaterally cryptorchic patients will more easily decrease to values which must be assumed to cause impairment, or destruction of fertility.

On the basis of these investigations certain *conclusions* may be drawn *concerning the treatment* advisable in the various forms of testis retention.

With respect to the unilateral retentions my investigations show partly that there is no difference in the fertility of operated

and non-operated patients — that is to say, no demonstrable effect of the operation — partly that unilaterally cryptorchic men must on the whole be considered normally fertile, hence the conclusion as regards unilateral cryptorchism must be that this affection requires no treatment for the sake of the fertility.

The chances of a spontaneous descent of originally retained testes being, according to the literature, about 60 %, and equally good whether the retention is unilateral or bilateral [BJERRE (1)], the prognosis for the latter affection is probably better if an eventually late spontaneous descent is awaited than if it is attempted to correct the position of the testes by operation; for the results of my investigations show that the functional outlook after orchidopexy for bilateral testis retention must be regarded as very bad, since the greater part of these patients are sterile or presumably have their fertility very considerably impaired, and in those cases in which atrophy of both testes has occurred as a result of the operation instead of the intended improvement, an aggravation has been brought about which is so serious that it should be a warning not to perform bilateral orchidopexy. Hence bilateral cryptorchism should be treated on the following lines: In the interval between the diagnosis and the time when puberty is approaching, *e. i.* until the age of 12—14, every form of treatment should be renounced and a possible spontaneous descent should be awaited. If this has not occurred or started at that stage, hormonal treatment should be instituted, large doses of gonadotropic hormones being administered in order to bring about or accelerate the descent. If energetic hormone treatment has not caused the descent of at least one testis when the patient is approaching the end of puberty, the outlook as regards fertility must be considered bad. So as to leave no means untried, *unilateral* orchidopexy should then be performed on the testis which it seems easiest to bring down into the scrotum, but it must be realised that the chances of obtaining a satisfactory result in this way as regards the production of sperm capable of fertilisation must be considered small.

The question now remains as to what should be done if pain, torsions, or hernia on the same side as the testis retention makes the patient consult the physician. The main lines to be followed should be as small and sparing operations as possible, especially in bilateral retentions, since there can be no doubt that operative treatment of the testes or the funicles renders difficult or prevents

a possible spontaneous descent. If there is hernia in conjunction with testes retention herniotomy should — as far as possible — be avoided until the possibilities of a spontaneous descent and perhaps hormone treatment have been exhausted. This applies in the first place to those cases in which there is bilateral hernia in conjunction with bilateral cryptorchism, while from our previous remarks it will appear that with unilateral cryptorchism in conjunction with hernia on the same side, more attention may be paid to the hernia than to the testis retention. In those cases in which a hernia must necessarily be operated *e. g.* owing to incarceration, the operation should be limited to herniotomy and the testis retention should not be corrected. In those cases, too, in which the patient consults a physician owing to pain, the very greatest reserve should be shown with respect to operation, so as not to obstruct a possible spontaneous descent.

Summary.

The object of this work is to investigate the fertility in operatively treated and untreated cryptorchism on the basis of sperm examinations carried out according to modern methods. On the basis of the sperm examinations the presumed impairment of fertility is classified as "slight", "moderate", and "severe" impairment, the frequency of abnormal heads, the amount of the ejaculate, and the motility being at the same time taken into consideration. Sterility has only been inferred in cases of aspermia.

The material comprises 124 patients in all.

Examination of the sperm from 9 patients with *untreated bilateral cryptorchism* revealed aspermia in all cases, and thus sterility.

Examination of the sperm from 25 *bilaterally cryptorchic men treated with orchidopexy* revealed 14 cases of sterility, 4 of presumably "severe", 2 of "moderate", and 3 of "slight" impairment, while in 2 cases, only, no sign was found of an impairment of fertility. These results show that the fertility in bilateral operatively treated cryptorchism is essentially poorer than the literature would seem to show.

Examination of the sperm from 36 *patients treated with orchidopexy owing to unilateral cryptorchism* showed 3 cases of sterility, 4 of presumably "severe", 4 of "moderate", and 10 of "slight"

impairment of fertility, while 15 exhibited no signs of an impairment of fertility.

Examination of the sperm from 35 patients with *untreated, unilateral cryptorchism* revealed one case of sterility, 7 of presumably "severe" 3 of "moderate", and 11 of "slight" impairment of fertility, while 13 exhibited no signs of an impairment of fertility.

A comparison of the two materials of unilaterally cryptorchic men shows that both the separate items of the sperm examination and the fertility estimates are very nearly identical. In addition it is seen that the patients of these materials produce on an average half as many spermatozoa as the men of a large American normal material. This result and the identity between the examinations of treated and untreated cryptorchic men would seem to show — like the examinations of the operated bilaterally cryptorchic patients — that *no essential production of spermatozoa takes place in the operated testes.*

On the basis of these investigations certain lines of treatment are suggested which are deemed advisable in the various forms of cryptorchism. Unilateral cryptorchism requires no treatment with a view to fertility. In bilateral cryptorchism a possible spontaneous descent should be awaited, occasionally in connection with hormonal treatment. Bilateral orchidopexy should not be performed lest it result in bilateral testicular atrophy.

Zusammenfassung.

Der Zweck der Arbeit ist auf Grund von Spermauntersuchungen, ausgeführt nach modernen Methoden, die Fertilität bei operativ behandeltem und unbehandeltem Kryptorchismus zu untersuchen. Auf Grund der Spermauntersuchungen sind vermutete Fertilitätsherabsetzungen in »leichte«, »mässige« und »schwere« Herabsetzung eingeteilt, indem bei den Schätzungen gleichzeitig sowohl die Häufigkeit der Spermienkopfabnormitäten als auch die Spermamenge und die Spermienmotilität berücksichtigt sind. Die Konklusion »Sterilität« ist *nur* im Falle von Aspermie angewandt.

Das Krankengut umfasst insgesamt 124 Personen.

Die Untersuchung des Spermas von 9 Kranken mit *unbehandeltem doppelseitigem Kryptorchismus* zeigte in allen Fällen Asper-

mie und damit Sterilität. Bei Untersuchung des Spermas von 25 *doppelseitig kryptorchiden Männern mit Orchidopexie behandelt* wurden 14 Fälle von Sterilität, 4 von vermutlich »schwerer«, 2 von »mässiger« und 3 von »leichter« Herabsetzung gefunden, während nur in 2 Fällen keine Zeichen von Fertilitätsherabsetzung gefunden wurden. Diese Resultate zeigen, dass die Fertilität bei doppelseitigem operativ behandeltem Kryptorchismus wesentlich schlechter ist als nach den Angaben der Literatur. Eine Untersuchung des Spermas von 36 *Kranken, die mit Orchidopexie wegen einseitigen Kryptorchismus behandelt waren*, zeigte 3 Fälle von Sterilität, 4 von vermutlich »schwerer«, 4 von »mässiger« und 10 von »leichter« Herabsetzung der Fertilität, während bei 15 keine Zeichen von Fertilitätsherabsetzung vorkamen. Bei Untersuchung von Sperma von 35 *Kranken mit unbehandeltem einseitigem Kryptorchismus* wurde ein Fall von Sterilität, 7 von vermutlich »schwerer«, 3 von »mässiger« und 11 von »leichter« Herabsetzung der Fertilität gefunden, während bei 13 keine Zeichen von Fertilitätsherabsetzung gefunden wurden. Aus einem Vergleich zwischen den 2 aus einseitig kryptorchiden Männern bestehenden Krankengütern ergibt sich, dass sowohl die einzelnen Glieder der Spermauntersuchung als auch die Fertilitätsbeurteilungen nahezu identisch sind. Zugleich zeigt es sich, dass die von diesen Krankengütern umfassten Patienten im Durchschnitt halb so viel Spermien als Männer in einem grossen amerikanischen Normalmaterial erzeugen. Dieses Resultat und die Identität der Untersuchungen von Sperma von behandelten und unbehandelten einseitig Kryptorchiden deuten — wie die Untersuchungen der operierten doppelseitig kryptorchiden Patienten — darauf, dass *keine wesentliche Spermienproduktion in den operierten Hoden erfolgt*. Auf Grund der vorgenommenen Untersuchungen werden gewisse Richtlinien für die Behandlung, die bei den verschiedenen Formen von Kryptorchismus zu empfehlen sind, gegeben. Einseitiger Kryptorchismus erfordert aus Rücksicht auf die Fertilität keinerlei Behandlung. Bei doppelseitigem Kryptorchismus empfiehlt es sich, einen eventuellen Spontandesensus, bisweilen in Verbindung mit Hormonbehandlung, abzuwarten. Doppel-seitige Orchidopexie soll nicht unternommen werden, um nicht doppelseitige Hodenatrophie hervorzurufen.

Résumé.

Le but de ce travail est de rechercher, sur la base d'examens du sperme, exécutés d'après des méthodes modernes, quel est le degré de fécondité dans les cas de cryptorchidie traités opératoirement et ceux qui n'ont pas été traités. Sur la base des examens du sperme, la diminution de fécondité que l'on suppose avoir constatée a été classée en différentes catégories: «légère», «modérée» et «grave» diminution de la fécondité, en tenant compte dans les estimations tant de la fréquence des anomalies des têtes des spermatozoïdes que de la quantité de sperme et de la motilité des spermatozoïdes. La conclusion «stérilité» n'a été appliquée qu'aux cas d'aspermie.

Le matériel d'observation porte sur un total de 124 malades.

L'examen du sperme de 9 malades souffrant de *cryptorchidie bilatérale non traitée* révéla une aspermie dans tous les cas et, par conséquent, un état de stérilité. L'examen du sperme de 25 *cryptorchides bilatéraux traités par orchidopexie* révéla 14 cas de stérilité, 4 de diminution probablement «grave», 2 de diminution «modérée» et 3 de diminution «légère», tandis que dans 2 cas seulement on ne trouva aucun symptôme d'une diminution de la fécondité. Ces résultats prouvent que, dans les cas de cryptorchidie bilatérale traités opératoirement, la fécondité est beaucoup moins bonne qu'elle ne devrait l'être si l'on devait en croire la littérature. L'examen du sperme de 36 *malades traités par orchidopexie à la suite de cryptorchidie unilatérale* montra 3 cas de stérilité, 4 de diminution «grave», 4 de diminution «modérée» et 10 de diminution «légère» de la fécondité, tandis que chez 15 malades, on ne trouva aucun signe d'une diminution de la fécondité. A l'examen du sperme de 35 malades atteints de *cryptorchidie unilatérale non traitée*, on trouva un cas de stérilité, 7 de diminution probablement «grave», 3 de diminution «modérée» et 11 de diminution «légère» de la fécondité, alors que chez 13 malades, il n'y avait aucun signe de diminution de la fécondité. Une comparaison entre ces deux séries d'observations de cryptorchides unilatéraux montre aussi bien dans les différentes phases de l'examen du sperme que dans l'appréciation de la fécondité que ceux-ci sont pour ainsi dire identiques. Il apparaît en outre que les malades dont il s'agit produisent en moyenne une quantité de sperme inférieure de 50 % à celle produite selon les

données obtenues par l'observation de nombreux hommes américains normaux. Ce résultat et l'identité des examens du sperme chez les cryptorchides unilatéraux traités et non traités — de même que les examens des cryptorchides bilatéraux opérés — semblent indiquer qu'il ne s'opère *pour ainsi dire pas de production de sperme dans les testicules opérés*. Sur la base des examens effectués, il est donné quelques directives quant au traitement que l'on doit conseiller dans les différentes formes de cryptorchidie. La cryptorchidie unilatérale ne demande aucun traitement par rapport à la fécondité. Dans les cas de cryptorchidie bilatérale, il convient d'attendre une descente spontanée éventuelle, parfois consécutivement à un traitement par hormones. Il ne faut pas pratiquer l'orchidopexie bilatérale, de crainte de provoquer une atrophie bilatérale des testicules.

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Paraxanthine Treatment of Hyperthyroidism.

By

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The treatment of hyperthyroidism with thio-urea, thio-uracil and, later on, methylthio-uracil has attracted great attention since the publication of the works by ASTWOOD (1943) and HIMS-WORTH (1943). A summary of the literature in this field was published recently by WIJNBLOED (1945). The results have been promising. Our experiences are as yet too few, however, to permit of any definitive conclusions as to whether and in which cases these substances are suited for præoperative treatment — or perhaps to be used as the only treatment — in cases of overactivity of the thyroid gland.

In 1943 CARTER and his collaborators, too, published their experiences of another substance with antithyroid effect, paraxanthine (1: 7 dimethylxanthine). Their work, which was entitled "Paraxanthine as a Natural Antithyroid Substance", attracted its due attention.

In human urine CARTER and collab. found a substance with antithyroid effect. They purified it and identified it as paraxanthine. In experiments on the frog's heart paraxanthine was found to neutralize the effect of thyroxine. The effect was optimal at a certain concentration. If this limit was exceeded the inhibitory effect decreased and ceased completely when the paraxanthine concentration had risen to double the optimum. If the thyroxine concentration is then raised instead, a "reversed" thyroxine effect was obtained until the thyroxine concentration had doubled. The relation between the paraxanthine and the thyroxine concentrations was now restored to the optimum of the neutralizing effect of paraxanthine. The experiment could be repeated by raising alternately the concentrations of paraxanthine and of thyroxine. CARTER and collab. conclude from these experiments that the activity of the frog's heart does not depend solely on the

amounts of thyroxine or paraxanthine, but on the *relation* between the concentrations of these two substances. — After having obtained the above-mentioned results, CARTER and collab. began to experiment with rats. By administering paraxanthine they were able to lower the basal metabolic rate (B. M. R.). The optimum dose of paraxanthine was found to be 20—25 μ gm per day for a rat weighing 200—250 gm. The B. M. R. then fell to about 70—75 % of its normal value. If the dose of paraxanthine was increased above this optimum, the B. M. R. began to rise and returned to normal with double the optimum dose. By overdosing the paraxanthine and at the same time administering thyroxine a fall of the B. M. R. was obtained. There is thus a good correspondence between the results of experiments on rats and those on the frog's heart. From these experiments CARTER and collab. concluded that paraxanthine behaves as an antithyroid substance in the body under normal conditions, and that the basal metabolic rate in rats is controlled by the relation between the amounts of paraxanthine and of thyroxine. They do not suggest, however, that changes in the paraxanthine concentration are used by the body to control the basal metabolic rate. They were not able to observe any special capacity of the body to control the amount of paraxanthine in the way the thyroid secretion is controlled.

In the available literature I have not been able to find any records of attempts to use the results gained by CARTER and collab. in the clinical treatment of hyperthyroidism. On the recommendation of Professor STRÖMBECK AB Ferrosan, Malmö, kindly put some paraxanthine to the disposal of the Surgical Clinic in Lund,¹ where it has been used in the treatment of some cases of overactivity of the thyroid gland. The material is as yet very small, but is nevertheless published as a contribution to the discussion of the treatment of hyperthyroidism with substances with antithyroid effect.

The material comprises in all 9 cases treated with paraxanthine.

Case 1. Journ. No. 734/45. 24-year-old unipara. Delivery in June 1944. In August 1944 the patient began to be tired, grew thinner, suffered from palpitations of the heart and easily got out of breath. Admitted to the Medical Clinic at the end of Jan. 1945. Had lost 15 kg during the preceding 6 months. State on admission: Nervous, thin, slight exophthalmus, no tremor. Weight 52.7 kg. Pulse rate 120. Blood pressure 135/80. B. M. R. + 51. Transferred to the Surgical Clinic on Febr. 5, 1945. Treated with recumbency and luminal (0.05×3) for 3 days. Pulse rate between 90 and 110. Paraxanthine was then given in a dose of $3 \times 2 + 4$ drops (each drop contains 0.19 mg paraxanthine). Next day the pulse rate was 86 and the B. M. R. $\left\{ \begin{array}{l} + 9\% \\ + 14\% \end{array} \right.$

¹ I should like to thank AB Ferrosan, Malmö, by whose courtesy the Surgical Clinic was provided with the paraxanthine necessary to these experiments.

This treatment was continued, but the pulse rate rose slowly and the B. M. R. rose in 5 days to $\begin{cases} +40\% \\ +38\% \end{cases}$. The paraxanthine dose was changed to 2 drops \times 3. The pulse rate fell slowly and the B. M. R. was after a further 5 days $\begin{cases} +31\% \\ +29\% \end{cases}$. The patient had lost 2.3 kg. The paraxanthine dose was changed once more to 3 drops \times 3, after which the pulse rate rose to above 110. The patient's condition became more affected, and we therefore went over to treating her with Lugol's solution. Under this treatment the B. M. R. fell to +14 in 10 days, and the patient was operated on after a further 2 days. Patho-anatomical diagnosis: Iodine-treated toxic goiter (fig. 1).¹ The post-operative course was uneventful, and the patient was dismissed in a fortnight; B. M. R. on dismissal — 7 %, weight 54.7 kg.

Case 2. Journ. No. 872/45. 43-year-old nullipara. Menstruations normal. The patient has felt tired and nervous during the preceding 1½ years. Treated twice at the Medical Clinic. Di-iodine thyroxine and luminal have been given without any effect. Last admission to the Medical Clinic in Febr. 1945. State at that time: Rather thin, moist skin, no ophthalmic symptoms, no certain enlargement of the thyroid gland, tremor in tongue and fingers. Pulse rate 130, blood pressure 145/90, B. M. R. + 37 %. One week later transferred to the Surgical Clinic, where, after a further 3 days in bed, the pulse rate was observed to be 100. Weight at that time 55 kg., B. M. R. $\begin{cases} +35\% \\ +33\% \end{cases}$. Paraxanthine 1 drop \times 3 was given. In 5 days the pulse rate and the B. M. R. fell to 80 and $\begin{cases} +12\% \\ +14\% \end{cases}$ respectively. Weight unchanged: 55 kg. The paraxanthine dose was reduced to 1 drop \times 2. After another 5 days the pulse rate had, however, risen to 100 and the B. M. R. to $\begin{cases} +22\% \\ +25\% \end{cases}$ and the patient had lost 1 kg. A further reduction of the paraxanthine dose to 1 drop \times 1 during one week had no effect, wherefore the dose was again increased to 1 drop \times 2. The pulse rate and the B. M. R. fell slowly while the patient put on weight. After 11 days with this treatment, during the last 4 of which the patient had been allowed to walk about, the patient was free from subjective troubles. B. M. R. then $\begin{cases} \pm 0\% \\ +4\% \end{cases}$, pulse rate 70—80, weight 56.6 kg. She was therefore dismissed but told to return for control at the Out-patients Dept. Since then the B. M. R. has been determined every 3rd week: the values have been normal. 2½ months later the patient began to work at gardening. The paraxanthine dose was reduced to 1 drop per day. An attempt to discontinue the administration completely was not successful, as the old troubles then set in again. At present, half a

¹ The histological diagnosis has been made by Prof. C. G. Ahlström, M. D., chief of the pathological institution at the university of Lund. For his help I beg to render my best thanks.

year after dismissal, the patient is quite fit for work and feels allright on a dose of 1 drop of paraxanthine per day. The B. M. R. lies around $+4\%$. No tremor can be observed in tongue or fingers, and the patient appears calm. Weight 58 kg.

Case 3. Journ. No. 1121/45. 60-year-old eight-para with an ulcer ventriculi in the anamnesis. The patient has lost 12 kg during the preceding 6 months, she has become nervous, got a tremor and palpitations and felt it difficult to breathe. During the last 2 months 2—3 water-thin evacuations per day. After being treated at the Medical Clinic for about a week the patient was transferred to the Surgical Clinic on March 3, 1945. State on admission: Nervous, rather thin, moist and warm skin, no opthalmic symptoms, fine-waving tremor in the fingers, thyroid gland possibly somewhat enlarged. Pulse rate 94, B. M. R. $+32\%$, weight 57.5 kg. Paraxanthine in a dose of 1 drop $\times 1$ has no effect. After 9 days the dose is increased to 2 drops $\times 1$, and after another 6 days to 3 drops $\times 1$, though still without any perceivable effect on the patient's condition. Pulse rate and B. M. R. remain practically unchanged. The patient gains 1 kg, however. After a further 8 days the paraxanthine dose is reduced to 2 drops $\times 1$. As no improvement can be observed during the following week, Lugol's solution is administered instead, and the patient is operated on after a further 2 weeks. Uneventful post-operative course. The patient is sent home subjectively and objectively calm.

Case 4. Journ. No. 1428/45. 41-year-old unipara with regular menstruations. During the preceding 3 years the patient has observed that her throat has grown thicker, she has felt nervous, suffered from palpitations, and transpired profusely. Her hair has become dry and falls out in great quantities. Good appetite. Does not think that she has lost any weight. Admitted to the Surgical Clinic on March 20, 1945. State on admission: Nervous exophthalmus, moist and warm skin, tremor in tongue and fingers, distinctly enlarged thyroid gland. Pulse rate 80, blood pressure 130/80—40. B. M. R. after two days in bed $\left\{ \begin{array}{l} +24\% \\ +31\% \end{array} \right.$. Paraxanthine is administered in a dose of 1 drop $\times 2$. The patient loses 2.5 kg. in 5 days but becomes calmer. The paraxanthine dose is increased to 1 drop $\times 3$, and after a further 8 days the B. M. R. is $\left\{ \begin{array}{l} +16\% \\ +14\% \end{array} \right.$, the patient is putting on weight and the pulse has become quiet. A subtotal bilateral hemistrumectomy is performed under local anaesthesia. The goiter seems perhaps slightly more sanguineous than after treatment with Lugol's solution. It is, however, not difficult to stanch the haemorrhage. The preparation shows microscopically a typical toxic goiter (fig. 2). During the post-operative course 4 drops of paraxanthine are given on the day of operation, and 1 drop less each consecutive day. The dosage 1 drop per day is kept for 4 days, after which the paraxanthine treatment is discontinued. The patient is conspicuously calm during the post-operative course; the pulse rate attains

a maximum of 96 on the day after operation at a temperature of 38.5° . One week after the operation the B. M. R. is $+6\%$, the pulse rate 70, and the patient is dismissed from hospital 2 days later, subjectively and objectively free from troubles.

Case 5. Journ. No. 2031/45. 40-year-old bipara with regular menstruations. Has felt increasingly nervous during the last month, lost weight, suffered from palpitations, and got out of breath easily. Admitted to the Surgical Clinic on May 4, 1945. State on admission: Nervous, excitable, moist skin, distinct tremor in tongue and fingers, slight exophthalmus, both lobes of the thyroid gland diffusely enlarged to about an egg's size. Pulse rate 120, blood pressure 155/75, B. M. R. after one week in bed $+63\%$. Cholesterol in the blood 130 mg %. Paraxanthine 1 drop $\times 3$ is administered. After 13 days the pulse rate has fallen to 100, the B. M. R. is $\begin{cases} +46\% \\ +48\% \end{cases}$, and the cholesterol content has increased to 167 mg %. The patient has lost 1.6 kg. The paraxanthine dose is increased to 2 drops $\times 3$. The pulse rate rises again to 120. The B. M. R. lies at $\begin{cases} +61\% \\ +59\% \end{cases}$, and during the next 8 days the patient loses a further 1.2 kg. The paraxanthine dose is changed again to 1 drop $\times 4$. As no improvement can be observed after a further 6 days the paraxanthine treatment is discontinued, and Lugol's solution is administered instead. Operation 3 weeks later. Uneventful post-operative course. The patient is dismissed from hospital on the 9th day after operation, subjectively and objectively calm.

Case 6. Journ. No. 2178/45. 70-year-old man, who has lost weight during the preceding 6 months, become nervous, and got a considerable tremor in his hands. The thyroid gland is just palpable. Blood pressure 155/90—75. Pulse rate 110. B. M. R. after 14 days in hospital $\begin{cases} +50\% \\ +48\% \end{cases}$. Paraxanthine is administered in a dose of 1 drop $\times 3$. The patient is allowed to walk about on account of his age. After 8 days the pulse rate has fallen to 80, the B. M. R. to $\begin{cases} +44\% \\ +42\% \end{cases}$, and the patient feels a considerable subjective improvement. The dosage is increased to 1 drop $\times 4$. As no further improvement is observed after another 9 days, Lugol's solution is given *at the same time* in a dose of 5 drops $\times 3$, which dose is increased to 10 drops $\times 3$ after a further 10 days. The B. M. R. remains at $\begin{cases} +37\% \\ +39\% \end{cases}$, however, and the pulse rate lies around 80. The operation proceeds without any complications, however, (subtotal bilateral strumectomy under local anaesthesia — see figure 3) and both paraxanthine and Lugol's solution are administered during the post-operative course. Of the former drug 1 drop $\times 4$ is administered on the day of operation, and one drop less each consecutive day. The patient is dismissed on the 11th day after operation, subjectively free from troubles.

Case 7. Journ. No. 2244/45. 55-year-old tripara. The patient has lost about 5 kg during the preceding year, become very nervous and shaky in the hands, transpired profusely, suffered from palpitations, and lost her breath easily. Extremely good appetite. Admitted to the Surgical Clinic on May 22, 1945. State on admission: Rather thin, nervous and restless, warm moist skin, marked tremor in tongue and fingers. No ophthalmic symptoms. Diffuse enlargement of the thyroid gland. Pulse rate 120, blood pressure 160/80. B. M. R. $\left\{ \begin{array}{l} +69\% \\ +70\% \end{array} \right.$ — cholesterol content in the blood 148 mg %. Paraxanthine is administered in a dose of 1 drop \times 3. On the 10th day the pulse rate falls to 80, and the B. M. R. to $\left\{ \begin{array}{l} +30\% \\ +28\% \end{array} \right.$, while the cholesterol value rises to 310 mg %. Subtotal bilateral strumectomy under local anaesthesia + nitrogen monoxide. The goiter is intimately adherent to its surroundings, and the haemorrhage more profuse than normally, although not difficult to stanch (see fig. 4). The post-operative course is complicated by pneumonia, which is treated with sulfonamidotherapy. No toxicity of goiter-type observed in the later course. Paraxanthine was administered in the following dosage: Day of operation and next day: 1 drop \times 4; then 1 drop \times 3 for 2 days, 1 drop \times 2 for 5 days, after which the treatment was discontinued. 14 days after operation the patient was dismissed in good condition without any nervous symptoms. B. M. R. on dismissal + 7 %.

Case 8. Journ. No. 2360/45. 59-year old nullipara. The patient has lost a good deal of weight during the preceding 6 months in spite of good appetite. She has become shaky in the hands, easily lost her breath and suffered from palpitations. Admitted to the Surgical Clinic on May 31, 1945. State on admission: Very thin (weight 49.4 kg.), "Glanzauge" but no exophthalmus, warm skin, tremor in the fingers, diffusely enlarged thyroid gland. Pulse rate 90, blood pressure 165/70, B. M. R. $\left\{ \begin{array}{l} +44\% \\ +47\% \end{array} \right.$, and cholesterol in the blood 143 mg %. Paraxanthine is administered in a dose of 1 drop \times 3, and, in 7 days, the pulse rate falls to 70, the B. M. R. to + 26 %, while the patient puts on 0.9 kg. Subtotal bilateral strumectomy is performed under local anaesthesia. The goiter seems to be more sanguineous and adherent to its surroundings than if it had been treated with Lugol's solution. It is not difficult to stanch the haemorrhage, however (see fig. 5). Markedly quiet post-operative course. The pulse rate rises to a maximum of 82. Paraxanthine is administered in the following doses: Day of operation: 1 drop \times 4, the next four days 1 drop \times 3, the next two days 1 drop \times 2, and the last 3 days 1 drop \times 1. The patient is dismissed from hospital on the 12th day after operation with a B. M. R. of $\left\{ \begin{array}{l} +10\% \\ +11\% \end{array} \right.$, a pulse rate of 60 and a weight of 51.1 kg. Subjectively and objectively free from troubles.

Case 9. Journ. No. 3234/45. 32-year-old nullipara. The patient has felt increasingly nervous and restless during the preceding 6 months. Suffers from palpitations and has lost a good deal of weight. Transpires profusely, and is shaky in the hands. Periodical diarrhoea. Admitted to the Surgical Clinic on August 7, 1945. State on admission: Nervous, restless, rather thin (weight 53.2 kg), tremor in tongue and fingers, slight exophthalmus, diffusely enlarged elastic thyroid gland. Blood pressure 145/90, pulse rate around 110. B. M. R. after 3 days in bed with 0.05×3 luminal per day $\left\{ \begin{array}{l} +32\% \\ +32\% \end{array} \right.$. Cholesterol in the blood 104 mg %. Paraxanthine is administered in a dose of 1 drop $\times 3$. In 5 days the pulse rate falls to about 100, the B. M. R. to $\left\{ \begin{array}{l} +28\% \\ +33\% \end{array} \right.$ and the cholesterol values rise to 175 mg %. The dosage is changed to 1 drop $\times 2$. After a further 5 days the pulse rate has fallen to 90, the B. M. R. to $\left\{ \begin{array}{l} +23\% \\ +23\% \end{array} \right.$, and the patient has gained 0.5 kg and become much calmer both subjectively and objectively. Operation 4 days later (subtotal bilateral strumectomy). The goiter is more brittle and adherent to its surroundings than a goiter treated with Lugol's solution (see fig. 6). It is not difficult to stanch the haemorrhage, however. Paraxanthine in a dose of 1 drop $\times 4$ is given on the day of operation, and one drop less each consecutive day. The pulse rate amounts to 130 on the day of operation but falls rapidly, and is only 100 on the following day. The post-operative course is mentioned in the journal as unusually quiet. The patient is dismissed from hospital in the 6th day after operation, subjectively and objectively calm, and with a B. M. R. of $\left\{ \begin{array}{l} +12\% \\ +12\% \end{array} \right.$.

Discussion.

As shown by the earlier reported work by CARTER and collab. paraxanthine exerts a neutralizing effect on thyroxine. This effect is optimal at a certain relation between the amounts of these two substances. If this relation is displaced in one or the other direction the neutralizing effect diminishes in order to disappear completely when the relation paraxanthine — thyroxine has become doubly optimal. We must therefore calculate with considerable difficulties in the individual case when trying to find the optimum dosage of paraxanthine for the clinical treatment of overactivity of the thyroid gland. Such expectations were also realized to the full in our clinical experiments, as is evident from the case histories summarized above. The treatment with paraxanthine could be carried out in only 5 of the 9 cases. On the other hand the results in these "successful" 5 cases indicate that paraxanthine exerts an antithyroid effect in man, too, and

that the substance may advantageously be used as such in the clinical praxis.

Præoperative and definitive paraxanthine treatment. The unit of the dosage has been one drop containing 0.49 mg paraxanthine. In 6 cases (2, 5, 6, 7, 8 and 9) the initial dose was 1 drop \times 3 per day. This dosage was kept unchanged in 2 cases (7 and 8) until the patient was in operable condition. In two cases (5 and 6) the dosage was increased to 2 drops \times 3 and 1 drop \times 4 after 13 and 8 days respectively in spite of an improvement having set in already at the first dosage. No further improvement was obtained by these larger doses. In case 5 a marked change for the worse set in, after which the dose was reduced to 1 drop \times 4. As the patient's condition still did not improve we changed over to treatment with Lugol's solution which had a good effect. In case 6 a præoperative treatment with Lugol's solution was administered at the same time as the paraxanthine, and the patient's condition improved so that he could be operated on. After administration of the initial dose of 1 drop \times 3 for 5 days in case 9 with a certain subjective and objective improvement the dosage was reduced to 1 drop \times 2. With this dosage the patient's condition became operable in another 9 days. The remaining case (2), where the initial dose was 1 drop \times 3, also showed some improvement after 5 days' treatment with paraxanthine. The dosage was then reduced to 1 drop \times 2, but a change for the worse then set in. A further reduction to 1 drop \times 1 gave no perceivable effect during one week. When returning to the dosage 1 drop \times 2 a good effect was obtained. With this dosage, which was reduced to 1 drop per day after 2½ months, the patient became fit for work and quite free from troubles. This case thus shows that paraxanthine *may* be used as the only treatment in cases of hyperthyroidism. That we need not suspect that it is a question only of a transient improvement, which coincides with but is independent of the paraxanthine treatment is shown with the greatest probability by the fact that this patient had earlier been treated for ½ year with di-iodine-thyroxine without any effect, and by the patient's getting back her earlier troubles if the treatment with paraxanthine is discontinued.

In one case (1) the initial dose was 3 drops \times 2 + 4 of paraxanthine. After a transient decrease of the B. M. R. to $\left\{ \begin{array}{l} + 9 \% \\ + 14 \% \end{array} \right.$ the rate rose again, which is why the dosage was reduced after 5

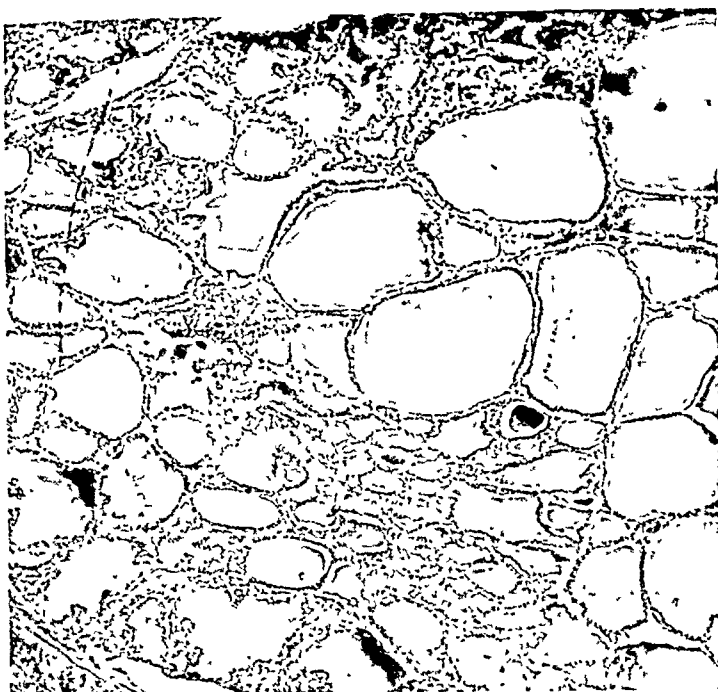


Fig. 1. (50 \times). Goiter treated præoperatively first with paraxanthine, then with Lugol's solution. The picture resembles a iodine-treated goiter.

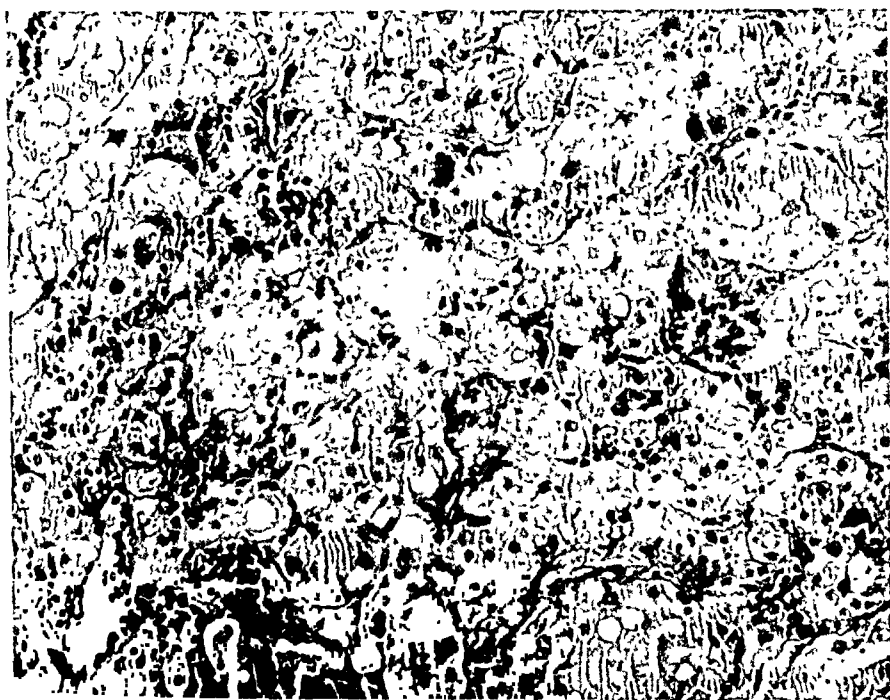


Fig. 2. (150 \times). Goiter treated præoperatively with paraxanthine only. Morphological diagnosis: Toxic goiter. No morphologically observable effect of the præoperative treatment can be definitely ascertained.

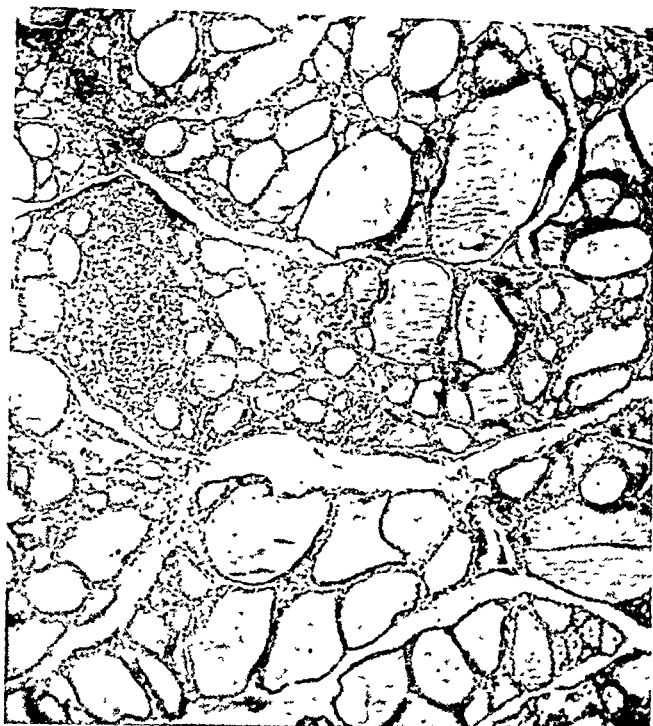


Fig. 3. (50 \times). Goiter treated praeoperatively with paraxanthine and Lugol's solution simultaneously. The picture corresponds to that of a iodine treated toxic goiter.

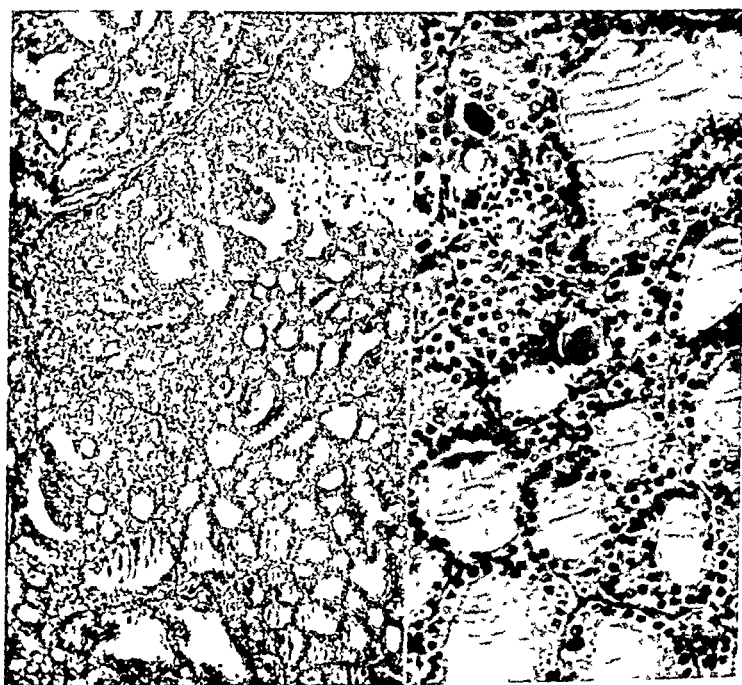


Fig. 4. (50 \times ; 150 \times). Goiter treated praeoperatively with paraxanthine only. Morphological diagnosis: Toxic goiter.

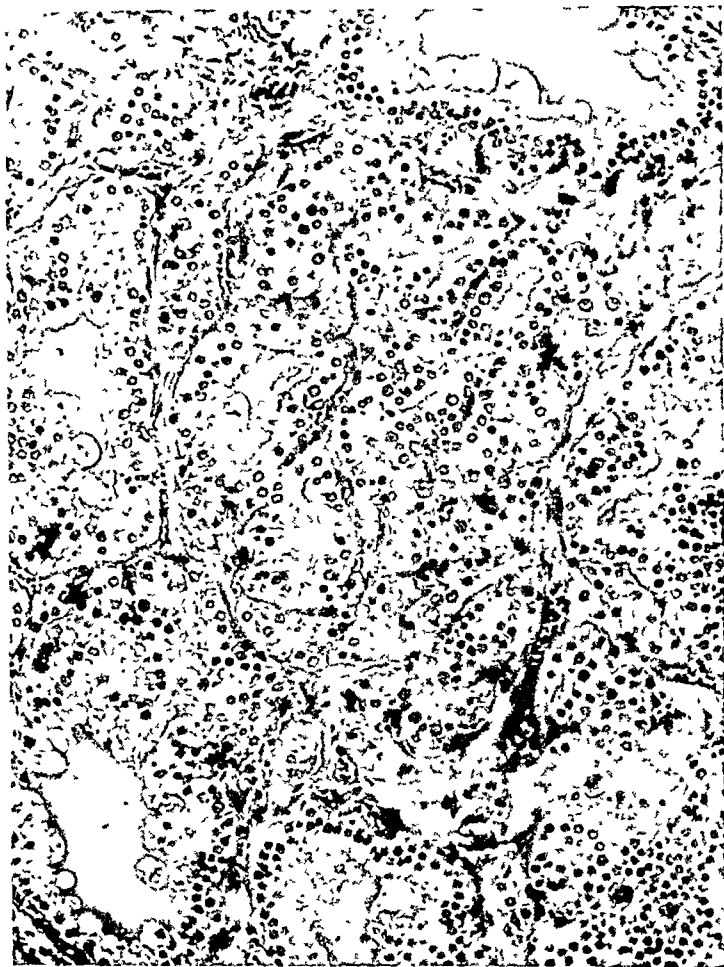


Fig. 5. (150 \times). Goiter treated præoperatively with paraxanthine only. Morphological diagnosis: Toxic goiter.



Fig. 6. (150 \times). Goiter treated præoperatively with paraxanthine only. Morphological diagnosis: Hyperactive parenchymatous toxic goiter.

days to 2 drops \times 3. The patient's condition improved, but when the dosage was increased anew to 3 drops \times 3 a marked change for the worse set in, and we had to resort to treatment with Lugol's solution. The patient's condition became operable after 12 days.

In one case (3) the initial dose was only 1 drop \times 1 per day. As no improvement had set in after 9 days, the dosage was increased to 2 drops \times 1, and a further 6 days later to 3 drops per day. This dose was administered for 8 days, after which it was reduced again to 2 drops per day for a week. No effect on the patient's condition could be observed either subjectively or objectively. We therefore changed over to præoperative treatment with Lugol's solution, and the patient was operated on with good results after a further 2 weeks.

These two cases (1 and 3) as well as case 5 show that a previous treatment with paraxanthine does not imperil the patient's chances of profiting by a præoperative treatment with Lugol's solution.

The experiences regarding præoperative or definitive treatment of hyperthyroidism which we have had here, might perhaps, though limited, justify our drawing up the following principles for subsequent experiments: In average cases of hyperthyroidism the initial dose should be $\frac{1}{2}$ mg paraxanthine 3 times per day. This dose should be kept as long as there are any signs of improvement. If the dose has to be changed, it is better to try a smaller dose than a greater. A certain type of dosage, which has had no effect on one occasion, may give good results in a later stage.

Post-operative treatment with paraxanthine. The increased toxicity displayed by patients suffering from overactivity of the thyroid gland after subtotal strumectomy is i. a. considered to be due to an increased resorption of thyroxine from the wound surfaces. The increase in pulse rate is a good indicator of the degree of toxicity. Lugol's solution is supposed to "make the follicles denser", thus diminishing the outflow of the incretion into the blood stream. It seems rather improbable that Lugol's solution should be able to exert such a "densifying" effect on follicles injured mechanically at the operation. Even in cases treated with Lugol's solution such a toxicity, more or less increased, is observed in the post-operative course. Paraxanthine, on the other hand, ought to inhibit the increased post-operative thyroxine outflow by its neutralizing effect, acting directly on the thyroxine, and thus render the post-operative course calmer.

Four cases (4, 7, 8 and 9) were put in an operable condition solely through the paraxanthine treatment. In three cases the dosage was 1 drop \times 3 daily, and in one case 1 drop \times 2 per day, immediately before the operation. On the day of operation the dose was increased to 4 drops to be reduced gradually afterwards with one drop at a time. In these 4 cases the post-operative course was remarkably quiet. In one case there was pneumonia in the after-course. In the other three cases there was a maximal increase in pulse rate to 96, 82 and 130 respectively on the day after operation. As a comparison might be mentioned that among the 104 cases treated with Lugol's solution and operated on during 1943—1944 at the Surgical Clinic in Lund on account of hyperthyroidism, 75 % showed a post-operative increase in pulse rate to above 96. The post-operative course in the cases treated with paraxanthine was strikingly quiet.

We cannot expect any morphologically observable effect on the thyroid gland from the treatment with paraxanthine. This is also confirmed by the micro-photographs (fig. 2, 4, 5 and 6) which show sections of goiters in toxic activity. But even if paraxanthine has been administered before or together with Lugol's solution it does not inhibit the normal effect of Lugol's solution on the goiter. This is illustrated by figures 1 and 3 respectively. Both show large follicles, rich in colloids, and they correspond on the whole well with the ordinary appearance of iodine-treated goiter.

Concluding remarks. The final question which has to be answered is whether the treatment with paraxanthine is in any respect superior to earlier methods of treating hyperthyroidism. While stressing the smallness of the present material, I want to point out, however, that paraxanthine as distinguished from the preparations of thio-urea and thio-uracil-type has not been found to give any complications in the form of nausea, erythema, conjunctivitis, elevated temperature, or leukopenia-agranulocytosis. In cases of hypersensitivity to iodine or where treatment with Lugol's solution is out of the question for other reasons paraxanthine ought to be tried. The post-operative course seems to be quiet after treatment with paraxanthine only, just as quiet as in cases where the treatment with Lugol's solution has been optimal. The results obtained from the administration of paraxanthine therefore seem very promising, and should be stimulating for continued experiments to obtain a wider experience.

Summary.

Overactivity of the thyroid gland has been treated clinically with paraxanthine (1: 7 dimethylxanthine) in 9 cases. Paraxanthine is a substance exerting an antithyroid effect in man, too, and may be used præ- and post-operatively, and as the definitive treatment. It is difficult to settle the optimal dosage. It was only in 5 cases possible to carry through the treatment with paraxanthine only; in one of these cases no operation was required. For subsequent experiments the author suggests an initial dose of $\frac{1}{2}$ mg \times 3 per day in average cases of hyperthyroidism. This dose has better be reduced than increased in the continued course. With due reservations for the smallness of the material, paraxanthine does not seem to have any secondary effects, and to give a quiet post-operative course if the dosage has been optimal.

Zusammenfassung.

In 9 Fällen wurde die Hyperfunktion der Thyreoidea klinisch mit Paraxanthin (1: 7 Dimethylxanthin) behandelt. Es wirkt antithyreoidal, auch beim Menschen, und kann sowohl prae- als auch postoperativ sowie zur definitiven Behandlung verwendet werden. Es ist schwierig, die optimale Dosierung zu finden. Nur in 5 Fällen konnte die Paraxanthinbehandlung durchgeführt werden; bei einem dieser Fälle ohne Operation. Für weitere Versuche wird bei mittelschweren hyperthyreotischen Zuständen eine Anfangsdosis von $\frac{1}{2}$ mg 3 mal täglich vorgeschlagen. Diese Dosis soll im weiteren Verlauf der Behandlung eher vermindert als gesteigert werden. Es hat den Anschein — unter gewisser Reservation in Anbetracht des geringen Materials — als wenn Paraxanthin keine Nebenwirkungen sowie einen ruhigen postoperativen Verlauf herbeiführe.

Résumé.

L'hyperfonction du corps thyroïde a été traitée cliniquement avec de la paraxanthine (1: 7 di-méthyle-xanthine) dans 9 cas. Chez l'homme aussi, cette matière a un effect antithyroïdien, et on peut l'employer préopérativement aussi bien que postopérativement ainsi comme traitement définitif. C'est bien difficile de trouver le dosage optimal. On n'a pu réaliser le traitement avec

de la paraxanthine que dans 5 cas; dans l'un de ces cas même sans opération. Voilà ce qu'on propose comme dose initiale dans des états hyperthyroïdiens d'une gravité moyenne. Il faut commencer avec une dose de $\frac{1}{2}$ mg trois fois par jour. Pendant le traitement suivant il faut plutôt diminuer qu'augmenter cette dose. Avec une forte réserve pour le peu d'expérience que l'on a, il semble que la paraxanthine ne donne pas des effets supplémentaires, et qu'elle donne, proprement dosée, un très calme cours postopératif.

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Clinical Experiences with Dextran as a Plasma Substitute.¹

By

G. BOHMANSSON, H. ROSENKVIST, G. THORSÉN
and O. WILANDER.

In 1943 GRÖNVALL and INGELMANN submitted a report to the annual meeting of the Swedish Surgical Association on dextran, its structure and physicochemical properties. At the same time they also described a number of experiments with the introduction of dextran into the blood of animals. They claimed that the properties of dextran should make it a suitable substitute for plasma, and also stated that, in view of its chemical structure, dextran could probably be broken down to glucose by enzymatic processes and therefore could be expected not to have the drawbacks of other plasma substitutes, such as gelatin, acasia, pectin and polyvinyl alcohol.

Blood, plasma and serum are well established agents in the treatment of traumatic shock, but they have certain disadvantages. They are difficult to procure in sufficient quantities and difficult to store and transport. The mass production of dried serum requires desiccation of large quantities of serum at one time, which means that sera from different donors are combined. The use of mixed serum has elicited undesirable reactions, including chills and rises in temperature. The presence of a latent virus infection in one donor suffices to contaminate the whole mixture. Infectious hepatitis seems to constitute an especially dangerous factor in this connection.

¹ Presented before the Swedish Association of Surgeons, Nov. 1944.

In view of the foregoing it is of the greatest importance that a substitute for plasma be developed. The criteria for a satisfactory substitute are as follows:

- 1) The product should be pure and atoxic.
- 2) It should be stable and should present no problems of storage and transportation.
- 3) It should have the same colloid osmotic pressure as plasma and the same water-binding power as the latter.
- 4) It should have the same therapeutic effect on shock as blood and plasma.
- 5) It should give rise to no reactions or morbid changes when introduced into the blood.
- 6) It should cause no local reactions in the form of thrombosis or tissue necrosis at the site of the injection.
- 7) It should be either consumed or excreted by the organism and not be deposited as a foreign substance.

Dextran is a polysaccharide built up of glucose molecules. The raw material may be secured as a special product in the manufacture of beet sugar through the action of *Leuconostoc mesenteroides* on saccharose. Raw dextran has a molecular weight of several millions. When administered in transfusions it causes damage to parenchymatous organs and gives rise to foreign-body reactions and thrombosis, as demonstrated by GRÖNVALL and INGELMANN. Before use it must be purified and hydrolyzed down to a molecular weight of about 100,000. The objective is a preparation in which most of the molecules are immediately above the kidney-filtration threshold and which is devoid of molecules of the size that cause tissue damage. The product with which we have been working constitutes a mixture of molecules of different sizes, varying between 30,000 and 150,000. For clinical experiments we first used a six percent solution in three percent physiologic saline with a viscosity of 4.5 to 5.2. The saline content was made so high in the hope of counteracting the increase in the sedimentation rate effected by the preparation.

The composition of the preparation was gradually modified on the basis of experiences gleaned from the clinical tests made during the first year at Örebro. The molecular size was reduced and the viscosity decreased to between three and four, at the same time as the saline content was lowered to 0.9 percent.

When the theoretical aspects of the problem had been clarified and the testing of the preparation in animals completed as a

result of GRÖNVALL and INGELMANN's investigations, the time was considered ripe to determine clinically whether dextran was suitable for human beings. In the autumn of 1943 Professor TISELIUS of the Physicochemical Institute in Upsala and *A. B. Pharmacia* came to an agreement with the Central Hospital in Örebro to have the clinical testing of the preparation conducted at the last-mentioned institution. Since so many preparations, later found to be unsatisfactory, had already been launched, BOHMANSSON and WILANDER made the proviso that the testing was to be conducted under their direct supervision and as their responsibility. They further stipulated that the testing at first be confined to Örebro and that not until later should other hospitals be included in the program. The importance of caution at the outset, with careful selection of suitable cases, as well as detailed analysis of the patients' reactions, is obvious. Since the mass production of constant and analogous preparations was attended by considerable difficulties, it was decided that only small experimental lots would be manufactured and that each lot would first be tested in hopeless cases of cancer. This was done at Stigberget's Hospital in Stockholm (Chief Medical Officer: Dr. LINDBORG), at first by GRÖNVALL and later by THORSÉN when the latter, who had taken part in the work in Örebro, was transferred to the Serafimer Hospital in Stockholm in the autumn of 1944. The results of the first year's experiments were so good that testing at other hospitals also was considered justified. Professor G. SÖDERLUND then agreed to have the experiments with dextran conducted by THORSÉN at the Surgical Service of the Serafimer Hospital.

At about the same time Professor A. TROELL gave permission for experiments with dextran, especially in cases of burns, in his service at St. Göran's Hospital in Stockholm. This work was carried out by ROSENKVIST.

There was close collaboration between *A. B. Pharmacia*, the Physicochemical Institute in Upsala, and those in charge of the clinical testing in Örebro throughout the period of experimentation.

The clinical testing was intended to provide answers to the following questions:

- 1) Is dextran harmless, giving rise to no temporary or permanent disturbances in the organism?
- 2) Does it fill the requirements of an anti-shock agent, *i. e.*

is its therapeutic effect in shock comparable with that of plasma and serum?

The disturbances caused by earlier plasma substitutes provided the clues for the analysis program in the present investigation. The main changes resulting from these substitutes were as follows:

1) The plasma substitutes were stored in the liver, spleen, and kidneys, where they caused reaction of various kinds.

2) They increased the agglutination tendency of the corpuscles, which in turn led to increased rouleau formation and sedimentation rate.

3) Some of the substitutes, notably polyvinyl alcohol, had an injurious effect on the blood; they led to a reduction in the hemoglobin content and the erythrocyte level, caused a shift to the left in the leukocyte picture, and brought about a decrease in the thrombocyte level with prolonged bleeding and coagulation times.

The most serious drawback of the earlier substitutes was the inability of the organism to excrete them. There is reason to believe that dextran is superior in this respect; it is composed of glucose, and the bonds between the glucose molecules can be broken within the organism, as shown by GRÖNVALL and INGELMANN. The aim of the investigation was therefore to determine by laboratory analysis the hemoglobin content, the hematocrit readings, the red and white blood counts, the differential count, the sedimentation rate, the nonprotein nitrogen, the carbon dioxide level, and the serum protein; the daily output of urine, the specific gravity of the urine, the reactions to the HELLER and ALMÉN tests, the urobilinogen and sediment, the urea clearance and the hippuric acid synthesis following the administration of sodium benzoate (according to QUICK).

The tests were instituted at the beginning of 1944; since then 22 different preparations in altogether about 1,000 bottles have been tested. Each preparation consisted of about twenty bottles of each lot of raw dextran.

At first the tests were made with a preparation with a viscosity of 4.5 to 5.2. Apart from a rise in the sedimentation rate, this preparation generally had no clinically appreciable ill effects. In one case, however, the patient became confused. This may have been the result of a too rapid infusion of the relatively viscous solution, which hindered mixture with the blood and gave rise to some temporary blocking of the capillaries. It was there-

fore decided to change over to a preparation of lower viscosity, or, in other words, to carry cleavage of the dextran molecules further. A number of infusions were then given with no appreciable ill effects. The testing had to be abandoned during late summer and autumn of 1944 due to the difficulties of securing pure dextran. Impurities of various kinds gave rise to allergic and pyrogenous signs. Satisfactory preparations have been available since March 1945. Although no clinically appreciable ill effects in the form of fever, urticaria, etc., have been observed since then, it has nevertheless been found necessary to discard a number of preparations in the preliminary tests due to mild urticaria and fever or lumbar pain.

Each preparation is submitted to preliminary clinical tests before it is released for general clinical use. This is done at Stigberget's Hospital in Stockholm.

The tendency to increase the sedimentation rate is also present in preparations of lower molecular weight, and levels of 30 to 70 mm. in one hour are reached following the administration of 400 to 800 ml. of dextran.

With regard to the possible effect of dextran on parenchymatous organs, our attention has been focused primarily on the liver and kidneys. The renal function has been kept under observation by keeping track of the urinary output, the specific gravity of the urine, the excretion of common salt, the sediment and nonprotein nitrogen, as well as the urea clearance. A slight rise in the nonprotein nitrogen levels has been observed in a few cases. This was mainly seen in cases in which dextran was given during an operation, and it is therefore impossible to say whether the rises were caused by the preparation or corresponded to the nonprotein nitrogen increases not unusual following major operations even when no transfusion has been given. The level returned to normal in a few days in these cases. In addition, these same patients showed no rise in nonprotein nitrogen following the administration of dextran not in conjunction with an operation.

No change in the function of the liver has been revealed by hippuric acid tests, phosphatase tests, and bilirubin and urobilinogen determinations.

In no case did dextran cause any change in the blood chemistry with regard to hemoglobin, erythrocyte, leukocyte, or thrombocyte levels, except of course for the effects of dilution. The bleeding and coagulation times were not affected.

The purpose of the therapeutic testing was to clarify the effect of the preparation on shock in man and as a prophylactic for postoperative shock. Comparisons were made with otherwise analogous cases which were treated with dextran and physiologic saline. Both series were submitted to the same examinations.

In addition to the laboratory tests, records were kept of the blood pressure, the pulse, the temperature, oscillometric readings, the general condition, and the subjective sensations.

The size of the doses, the number of transfusions, and the intervals between transfusions varied from case to case. Large or repeated infusions did not give rise to undesirable reactions or to increased sensitization.

The largest doses given in a short period were 1,600 ml. in six and a half hours and 3,200 ml. in four days; the largest total quantity given was 4,000 ml.

The clinical material included the following types of cases: gastric ulcer or cancer with or without hemorrhage, cholecystectomy with or without choledochotomy, shock from various causes, thoracoplasty, ileus of different origins, cancer of the colon or rectum, prostatectomy, excision of the urinary bladder, diffuse purulent peritonitis, burns etc.

Local effect:

The transfusions were given intravenously or intrasternally with a medium-gauge needle with an infusion time of ten to twenty minutes per 400 ml. Local thrombophlebitis was not observed in any case. Paravenous leakage gave rise to mild local tenderness, but no other local reaction. Intrasternal infusion led to no local reactions. Microscopic examination of the sternum in two cases showed nothing pathologic on one occasion and slight shrinkage of the medullary cells, perhaps due to the hypertonia of the preparation used, on another.

Blood pressure:

Dextran does not in itself lead to any rise in blood pressure. It acts by increasing the quantity of circulating fluid in cases of damaged vessels or disturbances in the peripheral circulation. Of 35 newly operated patients, 30 showed a rise in blood pressure, and the remaining did not; one of the five had a systolic pressure of 100, the others had normal values. Of 25 control patients given physiologic saline, 11 showed a rise in blood pressure, 8 showed no change, and 6 showed a decrease for the first few hours after

the infusion. The following curves illustrate the effect of dextran on the blood pressure. (Note the marked increase in a hypertonic case.) Figures 1 and 2.

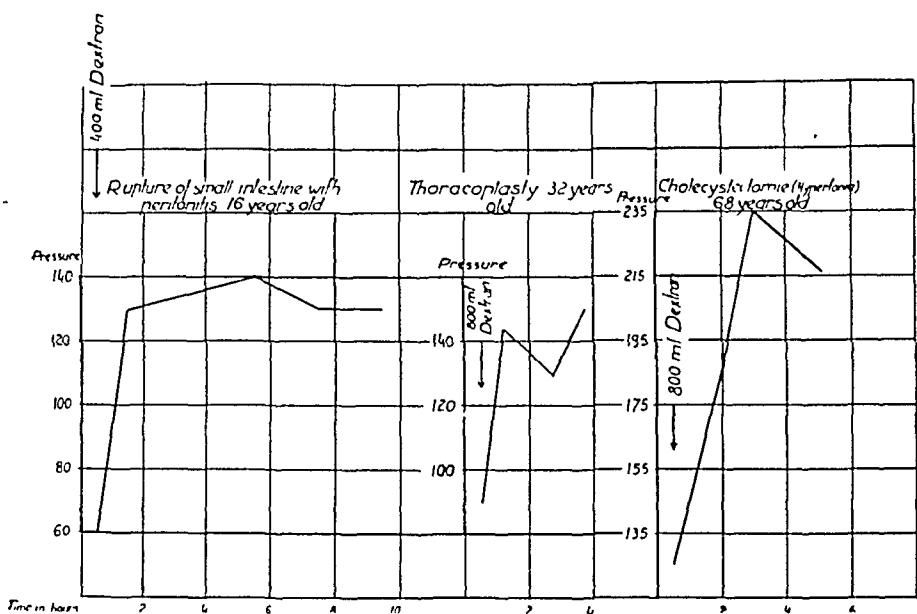


Fig. 1.

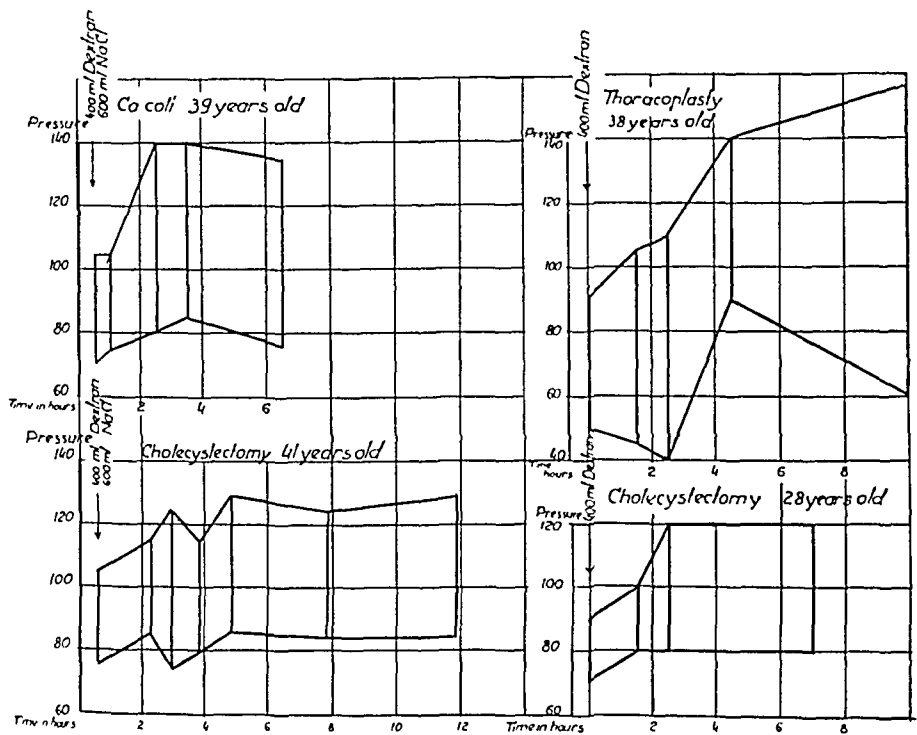


Fig. 2.

In all the cases of shock there was a good rise in blood pressure of satisfactory duration.

The two cases of shock described in the following are illustrative:

Case Stories.

No. 1. A man of 32 years had the following injuries: right-sided rupture of the adrenal gland, multiple ruptures of the liver, rupture of the spleen, thoracic fractures, laceration of the right lung. On admission the patient's complexion was ashen, he was cold and sweating profusely, and no pulse was perceptible. After 400 ml. of dextran the systolic pressure was 105, and after a further 400 ml. it was 125. The sweating diminished, and the temperature of the skin rose five degrees. A few hours later shock developed again, and a further transfusion had a good effect. The patient went into shock for the third time eight hours later in connection with the appearance of subcutaneous emphysema accompanied by a transitory rise in the blood pressure to 165, cutaneous chill, and sweating. These symptoms receded rapidly with 400 ml. of dextran. The patient succumbed twelve hours later from pulmonary hemorrhage. (Figure 3.)

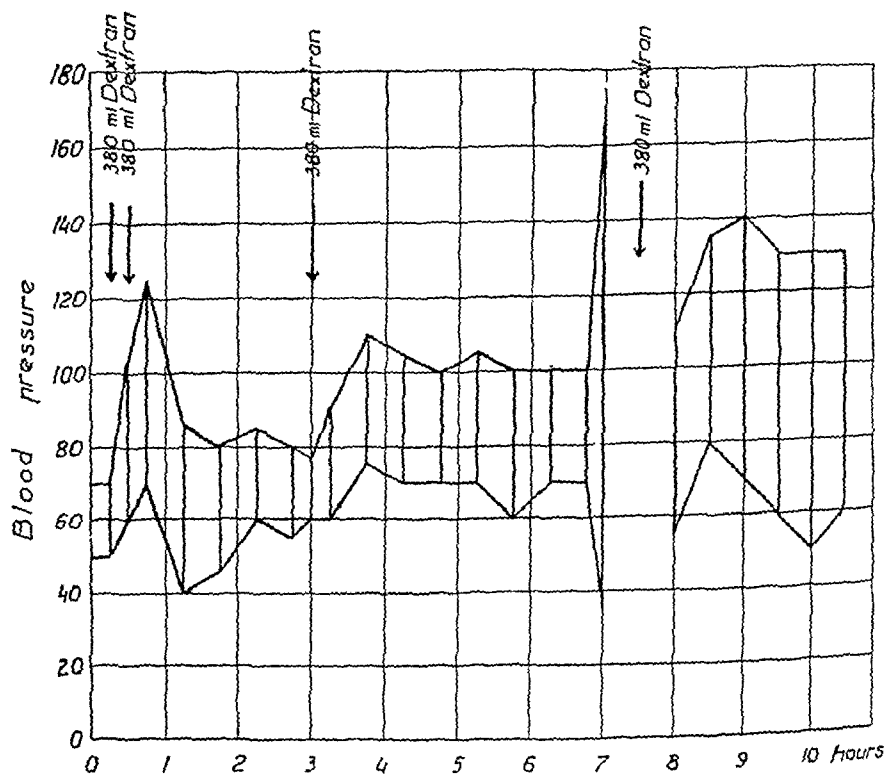


Fig. 3.

No. 2. A 65-year-old man with ulcer of ten-year duration also exhibited cardiosclerosis and hypertonia. He had undergone protracted cures for the ulcer condition. He was admitted on November 4, 1945, in severe shock, having fainted after a bad hemorrhage. Blood count: hemoglobin, 30 percent; erythrocytes, 1,200,000. The nonprotein nitrogen was 59, the sedimentation rate 8 mm. in one hour. A transfusion of 800 ml. of blood was given. There was another hemorrhage the next morning, and the patient was unconscious and did not react. The hemoglobin was 20 percent. 800 ml. of dextran was given intravenously, and the shock was relieved immediately. Gastric resection according to BILLROTH's first method was done for penetrating gastric ulcer with arterial arrosion. After the operation the patient was treated for anemia and hypoproteinemia with blood and plasma. He was discharged in good condition after four weeks. In this case the effect of dextran on the shock was rapid and complete.

The average pulse rate is lower following dextran than physiologic saline.

The temperature has shown no reactions with approved preparations that were not attributable to postoperative conditions. One patient who had first received dextran later had a chill following an intravenous saline infusion. In most cases viscose tubing was used for infusion in order to avoid reactions due to the poor quality rubber tubing of the war years.

The temperature of the skin rose appreciably in some cases but not at all in others.

Oscillometry showed increased values in four out of six cases examined.

The serum protein has not yet been investigated sufficiently thoroughly in this connection to permit of any conclusions. Studies on this point are in progress.

Investigations on the variations in colloid osmotic pressure and on changes in the volume of blood in connection with the administration of dextran are also under way.

The effect of dextran on the hemoconcentration should be evaluated against the background of the blood picture in eight healthy control cases.

Immediately after the infusion of 400 ml. of dextran the hemoglobin and erythrocyte levels and the hematocrit readings drop about ten percent as a direct consequence of dilution. About one hour later the drop is followed by a rise, which reaches or exceeds the original levels. Within the next eight hours there is a second drop to the levels first caused by the dilution. Whether the hemoconcentration is found to have decreased will therefore depend on

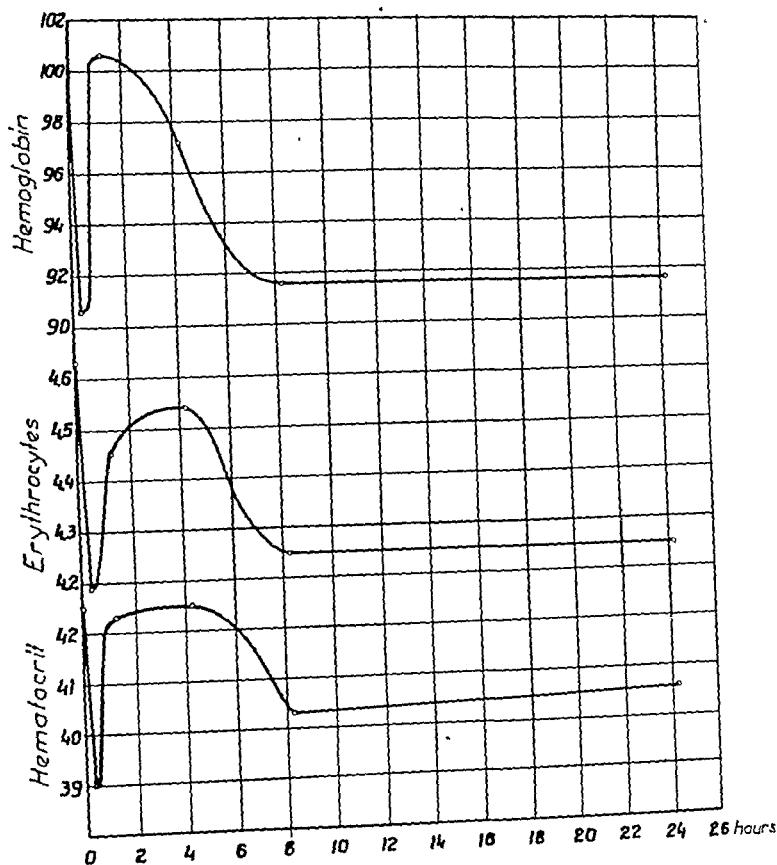


Fig. 4.

the time that has elapsed between the transfusion and the taking of the blood sample (Fig. 4). This phenomenon is probably explained by emptying of the blood depots, as indicated by experiments with blood corpuscles activated with P. 32 (THORSÉN).

A postoperative decrease in the blood levels is sometimes observed when physiologic saline is administered, but in the majority of cases it is only temporary, if it occurs at all, as appears from the following curves. (Figures 5, 6.)

The concentration of dextran in the blood and the mode of excretion of dextran can best be studied in the experiments on healthy control persons, in which the conditions were the same as those of the animal experiments conducted by GRÖNVALL and INGELMANN. This investigation was facilitated by a method described by HINT and THORSÉN for the determination of dextran in blood to be published at a later date. During a period of eight hours and most marked for the first four hours there is a rapid

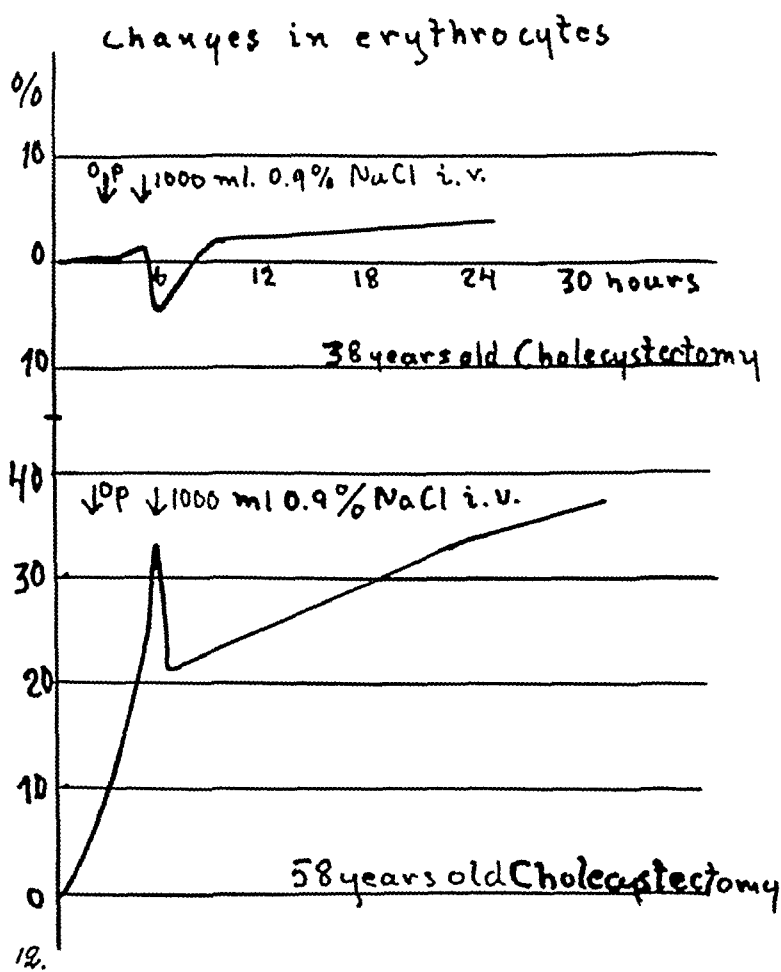


Fig. 5.

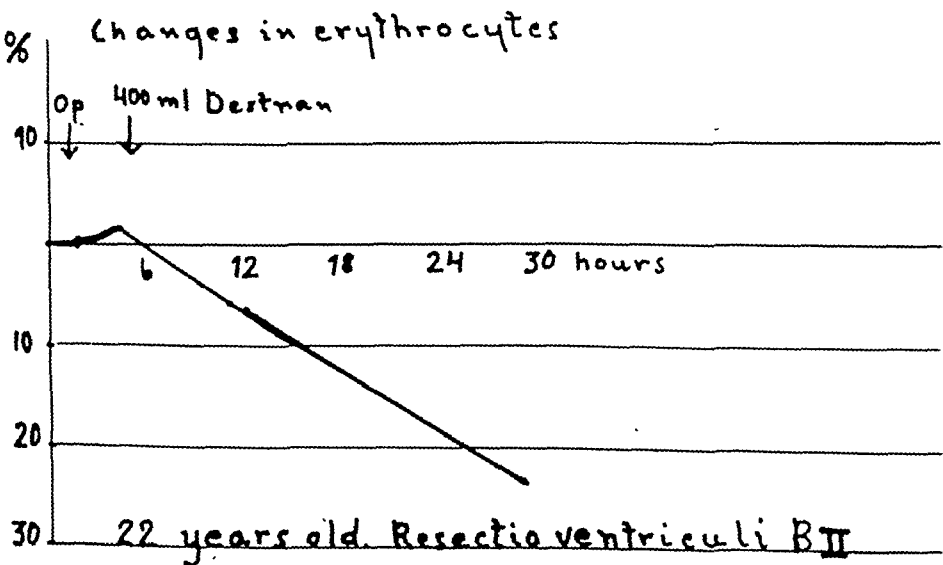


Fig. 6.

% Dextran
in blood

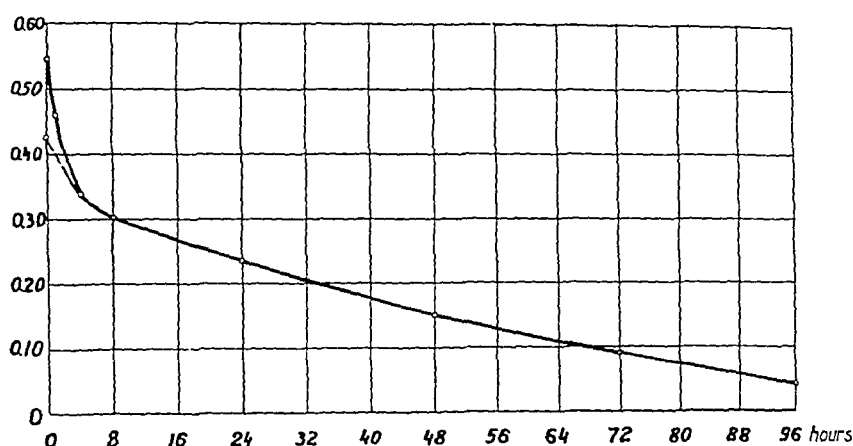


Fig. 7.

decrease in the dextran concentration in plasma. Thereafter the concentration decreases slowly for four to five days. Figure 7.

The first rapid fall results from the molecular dispersion of the substance. The smallest particles leave the blood during this period through the kidneys. The mean molecular weight is higher in the dextran present in plasma after 24 hours than in the infused dextran, and the mean in the latter is in turn higher than in the dextran found in the urine, from which can be recovered roughly one-fourth of the quantity of dextran infused. As a rule more than half of this amount, or about one-eighth of the total, reaches the urine within four hours. Only small quantities of dextran can be found in the urine by the time 24 hours have elapsed. In operated patients the excretion of dextran often continues into the second day.

Traces of albumin in the urine occur just as often following physiologic saline as dextran. Microscopic hematuria for three days was noted in one case following rectal amputation and in one case following gastric resection.

Subjective sensations in connection with infusion are either absent or correspond with those observed in relation to other intravenous infusions.

In one case there was a profuse hemorrhage through a thoracoplastic cavity in connection with the infusion of a dextran preparation approved for therapeutic use. The patient died six days later. The complication can be attributed to the transfusion,

but not to the substance infused, which apparently played no part in the fatal outcome.

Otherwise no complications developed in the operated series.

One healthy control showed highly transitory urticaria and itching of the hands. Another had a chill, a rise in temperature to 38.7 C, muscular pains, and headache 15 hours after the transfusion. The symptoms all disappeared in less than 24 hours. On a later occasion the same person complained of mild lumbar pain for 15 minutes after 50 ml. of the same preparation. In not one of about 50 allergic experimental persons could any allergic reaction to dextran be noted.

Similar but considerably more severe pain occurred in connection with the preliminary testing of non-approved preparations. The pain was of the same type as that which occurs in blood transfusions due to blood group differences. It occurred during or immediately after the transfusion and was relieved within one hour. Apart from mild urticaria in one case, no other reactions were observed. There were no signs of hemolysis, and no findings of interest were made in the sediment.

In burns dextran seems to be a valuable therapeutic agent, which can relieve hemoconcentration without at the same time decreasing the colloid osmotic pressure. The experiments conducted at St. Göran's Hospital and at the Central Hospital, Örebro, have not, however, been with dextran alone but always combined with plasma. It would probably be premature, therefore, to draw any conclusions as to the value of dextran in this type of case. Nevertheless the experiments seem encouraging.

Case Stories.

No. 3. A 73-year-old man had burns of 23 percent of the body surface, most of them third degree. Six transfusions of plasma and 1,000 ml. of saline were apparently of little use; the blood pressure showed a catastrophic decrease and the hemoglobin was more than 120 (normal, 80). There was a protracted chill after the sixth plasma transfusion, and the condition was very grave. The patient was then given 800 ml. of dextran, which had a surprisingly good effect and resulted in a considerable rise in blood pressure (from 75 to 110). Four hours later the patient took another turn for the worse, the blood pressure was down to about 60, the pulse was about 120, and a tremendous degree of edema had developed. After a further 800 ml. of dextran together with 1,000 ml. of saline, the blood pressure rose to 100, and the pulse became stronger with a frequency of 80. The fluid administration

was stopped 40 hours after the accident, since the edema had begun to be absorbed and the shock had been relieved. In this case the dextran seemed to have a better effect than plasma.

Dextran constituted the main therapy in one case, as follows:

No. 4. A 31-year-old man had burns involving 60 percent of the body surface. This case was judged a very poor risk from the outset. The patient was a disabled hobo. He was admitted at the same time as a friend, who had burns involving 50 percent of the body surface. The treatment of the former case was based on dextran, that of the latter on plasma. The dextran case received 4,000 ml. of dextran, 800 ml. of blood. A total of 9,200 ml. of fluid was given in 36 hours. The other case was given 4,000 ml. of plasma and in addition to what he was given to drink, he received altogether 9,800 ml. of fluid in 36 hours.

The dextran case was in better condition than the other one during the shock period. The blood pressure was 95 at its lowest, compared with 90 in the plasma case, and the hemoglobin was 120 at its highest, compared with 136 in the plasma case. Of even greater interest is the fact that the serum protein was the same — 5.0 and 5.1 %, respectively — in both cases after shock was relieved. Nevertheless, the general condition of the dextran patient remained poor the whole time; he was swollen to grotesque proportions, was confused, and showed motor unrest. He died on the fifth day, when the parallel case was subjectively in good condition despite high fever. Two weeks later, however, the condition of the plasma patient deteriorated, and death occurred on the seventeenth day, autopsy revealing bilateral pneumonia.

Since then dextran combined with plasma has been used in several cases of burns with different degrees of involvement of the body surface, as follows: one case with 25 percent involvement, in which 1,600 ml. of plasma and 1,600 ml. of dextran were given; one case of 32 percent involvement, in which 1,200 ml. of plasma and 1,600 ml. of dextran were given and in which there was a considerable rise in blood pressure during the dextran period; one case of 38 percent involvement, in which 2,300 ml. of dextran, 700 ml. of plasma and 700 ml. of blood were given; and finally one case of 58 percent involvement in which 1,900 ml. of dextran, 2,000 ml. of plasma, and 2,000 ml. of saline solution contributed to a successful outcome.

In addition dextran was used as the first measure in a case of major burns in a one-year-old child. The injection was intraosseal in this case.

It is still too soon to say whether dextran is the equivalent of plasma, and it is not certain whether in cases of severe burns dextran should be combined with plasma or regarded as a substitute for plasma. At all events, the results achieved hitherto are encouraging.

Summary.

Plasma substitutes are needed, especially in wartime. But even in peacetime it is becoming increasingly difficult to secure and store sufficient stocks of plasma or serum for therapeutic purposes. Shock treatment and shock prophylaxis require these substances in steadily increasing quantities.

Experiences in England and the United States, as well as in Sweden, have revealed that dried plasma produced from the mixed blood of several donors is by no means innocuous. Transfusions often lead to chills and fever; the presence of a latent virus infection in one of the donors contaminates the whole mixture. Infectious hepatitis, above all other diseases, appears to be a factor to be reckoned with in this connection.

The clinical testing of dextran up to the present would seem to justify the following conclusions:

1) Dextran can be produced in a sterile condition, free from virus. It does not alter when stored and need not be stored with special precautions.

2) Dextran is a colloid solution with approximately the same water-binding capacity as a physiologic protein solution.

3) The infusion of dextran leads to a rise in the sedimentation rate, which reaches its maximum at the completion of the infusion and fades away during the next few days. Great variations are observed from case to case.

4) Twenty-five percent of the dextran infused is excreted by the kidneys during the few hours immediately following the infusion. The blood shows dextran for at the most three or four days.

5) The dextran preparations tested recently do not appear to have any side effects worthy of mention.

6) Dextran is a good therapeutic agent in shock of various origins and is also of great value as a shock prophylactic.

7) Dextran cannot be used as a substitute for blood, plasma or serum in chronic hypoproteinemia or anemia.

8) The chemical structure of dextran makes it probable that it can be broken down in the organism by enzymatic processes, although this has not yet been definitely proved.

9) Difficulty has been experienced in producing a dextran preparation of constant composition. The sedimentation constant is satisfactory in the present preparations.

10) The possibility of hepatic and renal complications cannot be eliminated until several years have passed. No complications endangering life or of major severity have so far been observed with the dextran now used.

11) In shock the dose of dextran recommended is 800 to 1,600 ml., repeated as required. As a prophylaxis for shock, this dose may be diluted with equal parts of saline solution.

12) Infusion is done slowly (about 15 minutes for 400 ml.) and is given intravenously or intraossally. Paravenous leakage has not been found to constitute a serious difficulty. Local thrombosis has not been observed. Lumbar pain during the transfusion calls for immediate cessation of the process.

13) Individual sensitivity has been observed in occasional cases. It has not yet been discovered whether this is due to impurity of the preparation or is of allergic origin. The production of preparations free from contamination is still a difficult process.

14) Further experience is essential. A detailed study of a large series of cases is in the hands of THORSÉN and will be published at a later date.

Zusammenfassung.

Es liegt Bedarf an einem Plasmaersatz vor, besonders in Kriegzeiten. Auch in Friedenszeiten wird es immer schwerer, genügende Mengen Plasma oder Serum für therapeutischen Gebrauch zu beschaffen und vorrätig zu halten. Schockbehandlung und Schockprophylaxe erfordern in immer grösserem Ausmasse diese Mittel.

In England und den Vereinigten Staaten sowie auch hier in Schweden gemachte Erfahrungen zeigen, dass Trockenplasma, durch Mischung von verschiedenen Spendern hergestellt, durchaus nicht ungefährlich ist. Die Transfusion gibt oft Reaktionen: Schüttelfrost und Fieber. Vorhandensein einer latenten Virusinfektion bei einem einzigen der Spender verunreinigt die ganze Mischung. Vor anderen Erkrankungen scheint dies bezüglich die infektiöse Hepatitis einen Gefahrenfaktor von Bedeutung darzustellen.

Die klinische Prüfung von Dextran dürfte z. Z. folgende Schlüsse erlauben:

1. Dextran lässt sich steril, virusfrei herstellen. Es unterliegt bei der Verwahrung keinen Veränderungen und braucht nicht

unter Beachtung besonderer Vorsichtsmassregeln aufgehoben zu werden.

2. Dextran ist eine kolloidale Lösung mit ungefähr der gleichen wasserbindenden Fähigkeit wie eine physiologische Eiweisslösung.

3. Dextraninfusion steigert die Blutsenkungsgeschwindigkeit. Maximale Wirkung wird am Ende der Einspritzung erreicht; in den folgenden Tagen klingt sie ab. In den verschiedenen Fällen werden grosse Schwankungen beobachtet.

4. 25 % des Dextrans werden in den ersten Stunden durch die Nieren ausgeschieden. Im Blute lässt sich Dextran 3—4 Tage lang nachweisen, später nicht mehr.

5. Dextran scheint in den Präparaten, die wir in letzter Zeit versucht haben, keine ernsteren Komplikationen oder Gefahren mitsichzubringen.

6. Dextran ist ein gutes therapeutisches Mittel bei Schock verschiedener Art. Auch als Schockprophylaktikum ist es von grossem Wert.

7. Dextran lässt sich bei chronischer Hypoproteinämie oder Anämie nicht als Ersatzmittel für Blut, Plasma oder Serum verwenden.

8. Die chemische Struktur des Dextrans macht es wahrscheinlich (jedoch noch nicht sicher bewiesen), dass es durch enzymatische Vorgänge im Körper abgebaut werden kann.

9. Die Herstellung eines Präparates von konstanter Zusammensetzung ist auf Schwierigkeiten gestossen. In den jetzigen Präparaten ist die Sedimentationskonstante befriedigend.

10. Die Gefahr für Komplikationen seitens der Leber und der Nieren lässt sich nicht ausschliessen, ehe mehrjährige Erfahrung vorliegt. Bei der jetzt verwendeten Zusammensetzung des Präparates ist bisher keine lebensbedrohliche oder sonstwie ernstere Komplikation beobachtet worden.

11. Als Schocktherapeutikum wird empfohlen, 400—800 ccm. zu geben, je nach Bedarf wiederholt, bei Schockprophylaxe evtl. nach Verdünnung mit der gleichen Menge physiologischer Salzlösung.

12. Die Infusion ist langsam vorzunehmen (etwa 15 Min. für 400 ccm.), intravenös oder intraossal. Ernste Nachteile einer paravenösen Leckage sind nicht beobachtet. Lokale Thrombosen sind nicht beobachtet worden. Bei Lendenschmerzen während der Transfusion wird diese sofort abgebrochen.

13. Individuelle Überempfindlichkeit ist in vereinzelten Fällen

beobachtet worden. Ob dies durch eine Verunreinigung bedingt oder ob die Ursache allergischer Natur ist, ist noch nicht klargelegt. Es bestehen nach wie vor Schwierigkeiten, von Verunreinigungen freie Präparate zu erzielen.

14. Weitere Erfahrungen sind notwendig. Die eingehende Bearbeitung eines grösseren Materials ist THORSÉN anvertraut worden und soll später veröffentlicht werden.

Résumé.

Il existe, surtout en temps de guerre, le besoin d'un surrogat du plasma sanguin. Mais, même en temps de paix, il devient de plus en plus difficile de trouver et de conserver des quantités suffisantes de plasma et de sérum. Le traitement et la prophylaxie du choc réclament ces moyens thérapeutiques en quantités croissantes.

Les expériences faites en Angleterre et aux Etats-Unis aussi bien qu'en Suède, démontrent que le plasma desséché, mélange effectué avec les plasmas de plusieurs donneurs, n'est pas complètement inoffensif. La transfusion provoque souvent des réactions: frissons et fièvre; l'existence d'une infection latente par virus, chez l'un seulement des donneurs, souille tout le mélange. C'est surtout l'hépatite infectieuse qui semble être ici un élément dangereux non négligeable.

L'expérience clinique avec le dextran permet les conclusions suivantes:

1. Le dextran peut être stérilisé et débarrassé de virus. Il peut être mis en stock sans soins spéciaux et le temps ne lui fait perdre aucune de ses propriétés premières.

2. Le dextran est une solution colloïdale ayant sur l'eau le même pouvoir colloïdal qu'une solution physiologique d'albumine.

3. L'infusion de dextran élève la vitesse de sédimentation. L'effet maximum s'observe à la fin de l'infusion et diminue les jours suivants. On constate de grandes variations suivant les cas.

4. Le 25 % du dextran s'élimine par les reins pendant les premières heures. Dans le sang, on révèle la présence de dextran durant 5—6 jours mais pas au-delà.

5. Si l'on en juge par les préparations utilisées en dernier, le dextran ne paraît comporter ni complications ni risques sérieux.

6. Le dextran est un bon moyen thérapeutique dans le choc de causes diverses; il a également une grande valeur prophylactique.

7. Le dextran ne saurait se substituer au sang, ni au plasma ou au sérum dans l'hypoprotéinémie ou l'anémie.

8. La formule chimique du dextran permet de présumer — mais la preuve définitive manque encore — qu'il est décomposable dans l'organisme par des processus enzymatiques.

9. La préparation d'un composé constant a rencontré des difficultés. Dans les préparations actuelles, la constante de sédimentation est satisfaisante.

10. On ne saurait exclure les complications du côté du foie ou du rein avant de posséder le résultat d'expériences de plusieurs années. On n'a pas observé jusqu'ici de complications mortelles ou graves avec la préparation utilisée actuellement.

11. Comme thérapeutique du choc, on recommande l'administration de 400 à 800 cm³ de dextran, répétée suivant le besoin et comme prophylactique, après dilution éventuelle avec quantité égale de solution physiologique.

12. L'infusion — intraveineuse ou intra-osseuse — doit se faire lentement (15 min. pour 400 cm³). On n'a observé ni inconvénients sérieux aux extravasats paraveineux ni thrombose locale. En cas de douleurs lombaires, interrompre immédiatement la transfusion.

13. On a observé des idiosyncrasies sporadiques. La cause exacte: souillure ou phénomène allergique, n'est pas encore déterminée. Il est encore difficile d'obtenir une préparation complètement exempte de corps étrangers.

14. Des expériences ultérieures sont nécessaires. L'élaboration d'un matériel copieux est confié au Dr. THORSÉN et sera publié plus tard.

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From the Orthopaedic Clinic of Karolinska Institutet.
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A New Method of Arthrodesis in Arthritis Deformans Coxae.

By

ANDERS KARLÉN.

A characteristic of the symptomatology in arthritis deformans coxae is the contracture position usually in flexion-adduction-outward rotation. When performing an arthrodesis this faulty position, if marked, should be corrected with a view to ensuring the best functional result possible. Owing to the pronounced shrivelling of the soft parts surrounding the joint, and often also on account of purely mechanical obstacles caused by deformation of the joint ends, this can be done before the operation only in exceptional cases. Operatively, there are two ways available to master the situation: either an intra-articular arthrodesis, or a juxta-articular arthrodesis combined with a subtrochanteric osteotomy. An intra-articular arthrodesis is, in many cases, too severe an intervention. On the other hand, the juxta-articular arthrodesis gives, as appears from previous examinations, bad results in arthritis deformans coxae. None of these methods being thus practicable in certain cases, some other expedient must be found. Then the thought arose of combining a subtrochanteric osteotomy with a transarticular arthrodesis by pegging. The latter implies a much slighter intervention than an intra-articular arthrodesis, giving at the same time a much better result than the juxta-articular arthrodesis. However, to perform the pegging arthrodesis in the ordinary way by driving the peg in well below the subtrochanteric region, was not practicable. Under these circumstances the osteotomy would have to take place well down the femoral shaft, with worse healing conditions as a con-

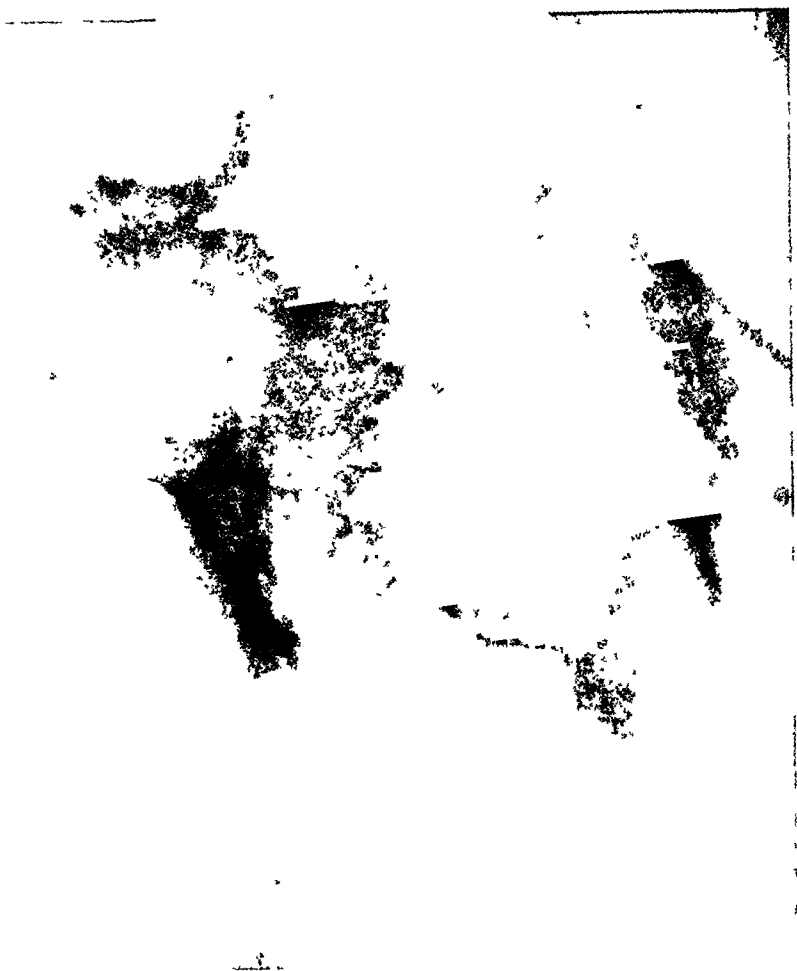


Fig. 1. A woman of 58. Pronounced arthritis deformans coxae with advanced reduction of the articular cartilage.



Fig. 2. The same case 6 months after the operation consisting of subtrochanteric osteotomy combined with intramedullary pegging arthrodesis. Complete consolidation of the osteotomy and bony ankylosis of the hip joint.

sequence. It was instead proposed to perform a subtrochanteric osteotomy and then to accomplish the pegging arthrodesis intramedullarily from the osteotomy surface.

In four cases the method has been employed at the Orthopaedic Clinic. In all of them there has been an advanced reduction of the articular cartilage. One of the cases is finally treated. Figs. 1 and 2 show the case before and after the operation.

The operative method is, in few words, as follows.

A pure lateral incision with subperiosteal exposure of the subtrochanteric region. Thereupon, according to the faulty position, either merely a transverse rotation osteotomy is performed for correction of the outward rotation, or a wedged-shaped osteotomy for correction of the flexion-adduction position. The two fragments are thereafter drawn apart, and through the medullary cavity of the proximal fragment the transarticular pegging arthrodesis is then performed in the usual way after introduction of a conductor with the aid of a Sven Johansson drill and roentgenologic control of the position of the conductor. The peg is driven in so far that the distal fragment can be moved without difficulty over the peg-head to good contact with the proximal one. Osteosynthesis as usual with steel wire through holes bored out in the fragments. It is recommendable to pull the steel wire through before driving the peg into place, since, otherwise, it sometimes happens that difficulties arise when pulling the wire through the proximal fragment.

The method involves a disadvantage. In the event of an infection or of an aseptic peg osteitis with dissolution of the peg, its sunken position makes it rather difficult to extract. However, through the introduction of an indicator and subsequent roentgenologic control of the position of the peg-head, there will hardly be any difficulties connected with the extraction through a hole chiselled out in the corticalis. On the other hand, through this method a complication, which is fairly frequent in cases of pegging arthrodesis, viz. the sliding of the peg, is entirely precluded.

Furthermore, it should perhaps be observed that there may be some risk of a pseudo-arthritis arising at the osteotomy through foreign-body effect of the peg. This has not occurred in the case first operated, and also in another instance the last roentgenologic control reveals callus filling between the osteotomy surfaces as well as a thin periosteal callus. Subsequent observation of this — as well as of the two remaining cases — will no doubt

make clear how great this risk is.¹ Should the method prove to give the results expected, it would thus be suitable for older, somewhat fragile cases, where a total arthrodesis may be regarded as too dangerous an intervention and in which an ordinary trans-articular pegging arthrodesis is not practicable on account of the preoperatively incorrigible faulty position.

Summary.

The author describes a new arthrodial method, subtrochanteric osteotomy combined with intramedullary transarticular rivet arthrodesis, intended for old, somewhat more fragile cases of arthritis deformans coxae, in which an ordinary total arthrodesis can be considered as being too severe an operation and in which an ordinary transarticular rivet arthrodesis cannot be performed on account of the preoperative faulty position which could not be corrected.

Zusammenfassung.

Verf. beschreibt eine neue Arthrodesemethode: subtrochantäre Osteotomie, kombiniert mit intramedullärer, transartikulärer Nagelarthrodese, und zwar für ältere, etwas hinfälligere Fälle von Arthritis deformans coxae, bei denen eine gewöhnliche totale Arthrodesse als ein zu grosser Eingriff anzusehen ist, und wo wegen der präoperativ, nicht korrigierbaren Fehlstellung die gewöhnliche transartikuläre Nagelarthrodese nicht vorgenommen werden kann.

Résumé.

L'auteur décrit une nouvelle méthode d'arthrodèse, à savoir une ostéotomie sous-trochantérienne combinée avec une arthrodèse par enclouage intramédullaire et transarticulaire; elle est destinée aux sujets âgés et un peu fragiles, atteints d'arthrite déformante de la hanche, chez qui l'arthrodèse courante totale doit être considérée comme une intervention trop importante, et où une arthrodèse ordinaire par enclouage transarticulaire est impracticable à cause de la malposition impossible à corriger avant l'opération.

¹ Later observation shows complete consolidation in furthermore 2 cases.

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Operative Treatment of Large Ventral Hernias with Metal Wire-Netting.

By

MAC FELLÄNDER.

Large ventral hernias are often difficult to handle. The patients are sometimes corpulent and have not infrequently been previously operated for the same rupture. The tenacity of the tissue is poor and its elasticity is impaired. For this reason it happens that they are judged as being beyond operative treatment and are advised to wear a girdle or corset. Incarceration occurs by no means seldom, and one is then obliged to intervene on vital indication.

In this respect cicatricial and umbilical hernia are the most common. Inguinal hernia is less frequent. A direct suture of musculi recti is possible in most cases of pure rectus diastasis with well developed musculature and rectus sheath. It can occur that the tension is such as to render desirable a strengthening of the abdominal wall with another material in order to lessen the strain. In other cases of large cicatricial hernia the musculature is degenerated and the fascia scarred or atrophic which reduces the prospects for a simple plastic with fascial covering. Various methods have been proposed for strengthening the abdominal wall of such cases.

The simplest way of strengthening a middle-line suture is to lay a piece of the anterior rectus sheath over the row of slitches, (ROTSCHILD) but the result will be a weak place in the abdominal wall where hernia can develop. The anterior rectus sheath is considered to be that part of the abdominal wall which is most tenacious and which therefore should be preserved intact (MEYER).

In 1910 and 1913 KIRSCHNER published his results of fascial transplantation in hernial surgery. Fascia lata is very suitable for

this purpose. KIRSCHNER employed patches of fascia both as a strengthening medium for the abdominal walls and as substitute in the event of defects, *i. e.* after great injuries and operated tumours in abdominal wall. He was able to prove irritation-free healing of the graft. KIRSCHNER applied outspread patches of fascia which were stretched taut and then sewn. He has had many followers and the experiences are favourable. Later on, other methods with fascial transplantation have been employed, and among these was GALLIE'S use of strips of fascia lata as suture material ("living suture material"). BURDICK and others applied this method in over 1,000 cases but the frequency of infection and relapse was far too great. Reoperation has revealed no traces of the fascial sutures. GALLIE however seems to have relinquished this technique and combined patch transplantation and suture with "living material". The side edges of the stretched fascial patches are split into strips some cm wide, threaded on a fascial needle, and sewn from within outward through the edges of the hernial openings. The strips on the one side are tied to corresponding strips on the other, upon which the edges are drawn as close together as would seem advisable. The sutures are strengthened with catgut. It appears uncertain as to whether this complicated suturation has any advantage over the fascial transplantation with ordinary sutural material in which method the transplanted graft is fixed under tension and reaches a little beyond the edges of the hernial openings to avoid the risk of recurrence at the margin. In addition to such fascial transplantation, tailed sheets of fascia lata (WANGENSTEEN) have been employed, but their field of application is limited to the inguinal region.

Before fascial transplantation began to be used, attempts had been made to strengthen the abdominal coverings with extraneous material. To begin with netting of stiff metal wire came into use. This, however, had the drawback of breaking to pieces when displacement of the tissue occurred, which must happen with bodily movement. The method was criticized generally. One feared infection and irritation from contact with extraneous bodies. In 1928 GOEPEL published his experiences with a new metal-wire netting, which he called ring-netting, and which consists of larger rings connected between themselves with smaller rings (see fig. 1). By means of this device a certain displacement can occur between the rings and the breakage is avoided. He had applied the method in 50 cases during 15 years and had achieved ideal results to 92 %.

In 1933 he reported 86 investigated cases, with similarly good results. In reply to a question in *Der Chirurg* 1932 as to the value of these metal wire plastics, several surgeons, among others KIRSCHNER and NORDMANN, were definitely dissuasive. It is not known, however, whether their failure referred to the earlier model with the stiff netting. Others, on the contrary, have met with success. Since then other German authors have reported their results with ring netting (USADEL 14 cases, STACKLOFF 8 cases). NORDMANN appears

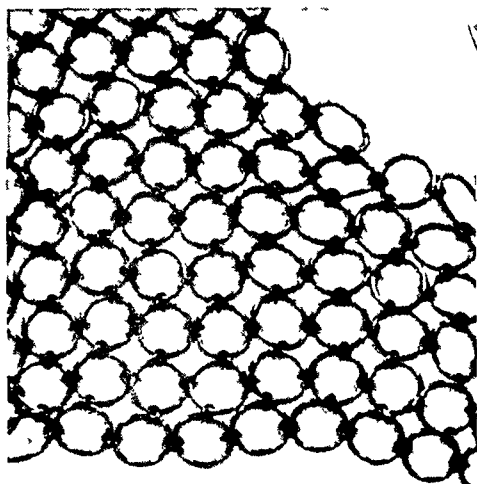


Fig. 1.

to have changed his opinion regarding the value of the same but uses fascia lata for strengthening purposes in cases of defective muscle-fascia plastic. In Anglo-Saxon literature I have only seen the method mentioned by NEUFELDT in connection with the description of one case. I have not found a single account in any Scandinavian literature, but the method has been casually mentioned by LINDGREN among others discussion-wise in The Swedish surgical society's transactions (*Svensk kirurgisk förenings förhandlingar* 1938) as a precursive report from the Örebro hospital.

In the beginning GOEPEL employed silver netting, afterwards netting of stainless steel. The juices of the tissue act upon the silver and form sulphide which stains the tissue black, but this, according to GOEPEL, is of no significance. Silver netting heals-in free from reaction. Netting of steel heals similarly without reaction, and is not affected by the tissue-juices. The essential for a successful result is absolute asepticism. GOEPEL had 2 cases, however, with primary healing in which resection of the small intestine was per-

formed simultaneously. He also published a detailed account of the technicalities connected with the plastic operation, of which mention of the following should not be omitted. The hernial openings shall be closed as tightly as possible by means of fascia, at which performance even inferior tissue, cicatricial tissue for instance, can be used. Fascial sutures made with too much tension cut through the tissue and wear it to shreds. It is specified also that one should avoid spreading the net freely over gaps in the fascia, and that the net should not be placed directly on the peritoneum. Should fascia be lacking one has recourse to plastics of fascia, or omentum etc. The net is placed epifascially over the hernial opening, not behind the fascia. In every direction it shall extend 5 cm beyond the edges. The fascial surface shall be prepared beforehand so that the net can be placed there. The net is spread out and fixed in the fascia with sutures, beginning at the four corners, whereupon all the rings along the side edges are then fastened. A plastic operation carried out in this way affords excellent support to the weak abdominal wall. Not only does the net provide a mechanical support, but it is also instrumental in bringing about reaction of the tissue, which gives rise to an ingrowing cicatricial tissue between the rings. The final result will be a strong, firm scar within which the net is ingrown.

My own material. At the Örebro hospital's surgical department between the years 1938 and 1943, similar plastic operations with wire netting were performed in 19 cases, of which 15 were women and 4 men. The ages of the patients varied between 33 and 69 years, the average age being 52 years. The majority of cases were corpulent women.

The situation of the hernia:

3 cases centrally above the navel.

4 » hernia of the navel.

9 » centrally below the navel.

2 » right fossa iliaca after appendectomy.

1 » right fossa iliaca after traumatic muscular rupture in connection with compound fracture of the pelvis.

There are no exact statements as to the size of the hernia but one finds such indications as, "as large as a man's head" etc. For this reason a photograph of one of the cases prior to and after the operation will serve to illustrate the size (see Fig. 2).

In 6 of the cases no plastic operation had been performed earlier, in 9 cases the operation had taken place once before, in 3 cases

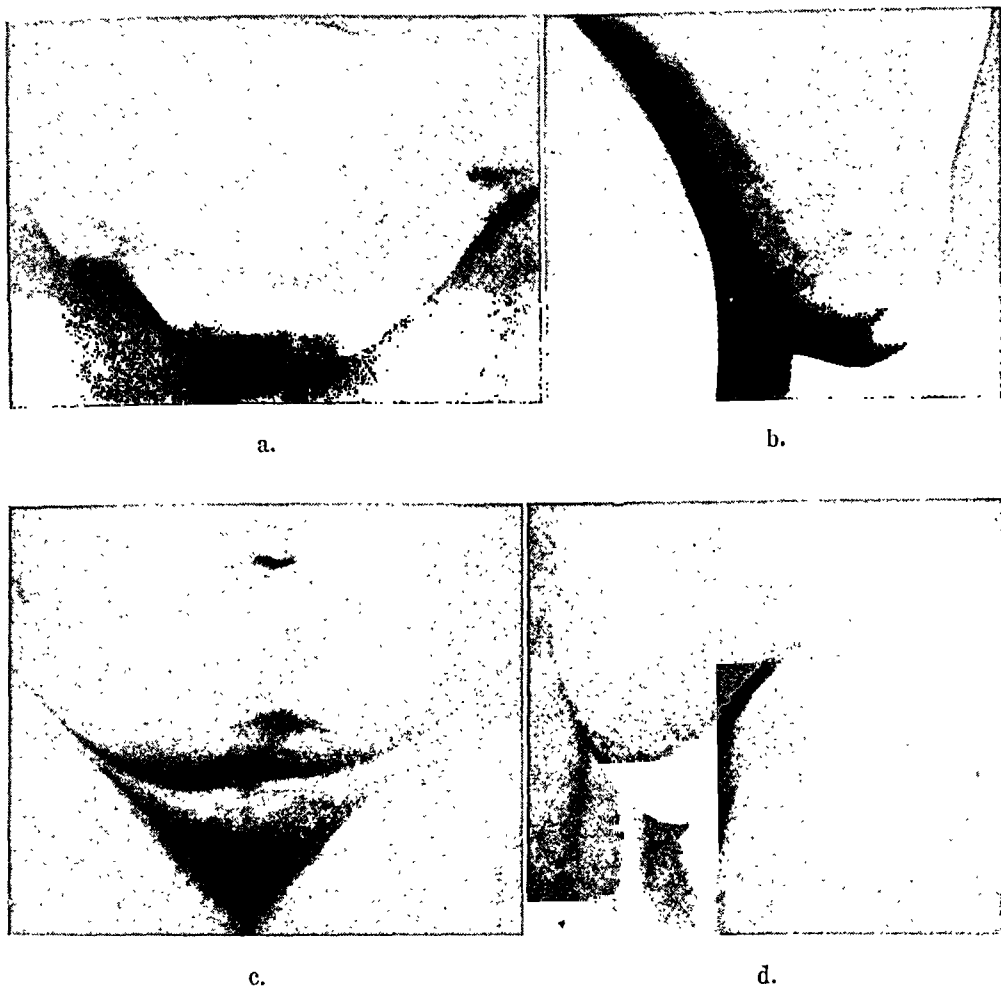


Fig. 2. Anterior and lateral view before and after operation.

twice, and in 1 case four times. A description of the material reveals the patients as being anything but pleasing operational objects. Each case was judged impossible for simple plastic operation.

Operational technique. The operation is performed under spinal anaesthesia in order to reduce the abdominal muscles to as great a state of relaxation as possible. The edges of the hernial opening were prepared in the usual manner. If possible the anterior surface of the fascia is divested of fat in all directions to about 5 cm from the edges of the hernial opening. The hernial sac was extirpated when it was found necessary. The peritoneum was sewn with continuous suture, and the hernial opening was drawn together as much as possible with the aid of fascia musculature and cicatricial material whichever was available. This done, a suitable piece of

the netting was placed outstretched before the sutured fascia (epifascially). Under a fair tension the four corners were fixed first with suture in the fascia, then all the rings along the side edges were fixed taking good care that the whole of the netting lay well under tension. As an additional security some of the rings situated within the netting were also sewn to the fascia. In 7 of the cases the netting was placed direct on the peritoneum and sewn at the edges of the hernial opening. In these cases sutures of fascia or other tissue were not possible. A greater tendency towards recurrence seems apparent here at the edges of the netting, however, for which reason one should if possible place the netting so that it lies 5 cm beyond the edges of the opening in all directions. It would seem of importance that the fixing be performed under fairly strong tension to lessen the strain on the fascial sutures, earlier made. Stainless steel wire was employed as suture material with advantage. As in all hernial plastics aseptic conditions and careful blood-staunching are essential for good results.

The post-operative course. 14 cases were discharged from the hospital healed per primum without relapse. Post-operative ileus developed in one case which led to laparotomy and ventricular fistula. There was slight superficial infection in 2 cases, which healed spontaneously. (In one of these the bladder was injured during the operation.) An infected hematoma complicated one of the cases and rendered the extraction of the netting necessary one month after the operation. The healing was afterwards complete without relapse. One case failed entirely however. The operational wound burst and the netting was found crumpled up and lying along the one edge of the hernial opening. In one case an abscess with remaining fistula appeared one year after the operation. This necessitated the extraction of the netting. Great cicatricial masses were revealed which could be joined and formed into a firm wall. In this case the netting lay against the peritoneum. There had been no fascial sutures in the first operation. Of the discharged patients one returned two years later with a slight recurrence at the upper edge of the ring-mail. The operation was renewed, a suture easily made, and there has been no recurrence since. In still one more case there was a recurrence which made reoperation necessary twice, one and four years respectively after the first ring-mail operation. On the first occasion an extra piece of netting was laid below the first, the second time it was sufficient to fix the ring-mail on the one side, but again slight recurrences made themselves manifest.

Reinvestigations. Of the 19 operated cases there remain 18 which are partly or wholly successful. On investigating the unsuccessful case three years after the operation, the large hernia was found to be giving much trouble, but strange to say, not more than before the operation, although the ring-mail still lay crumpled up along one side. It had obviously healed-in free from irritation and in itself is no cause of discomfort. A renewed operation has been



Fig. 3.

declined. On inquiry 3 of the remaining 18 cases were not to be found but the other 15 have been investigated. Examinations have been made 1—6 years after the operation. One of the patients died of another disease and was only examined half a year subsequent to the operation. As recurrences generally appear within the first year, none should have been passed by in this investigation. In 9 cases the examination was personal, in the other cases questionnaires were answered. The patients who appeared for personal investigation also underwent X-ray examination at which the ring-mail displayed no change. In each case it lay stretched out as at the operation (see Fig. 3). The investigation revealed that 8 patients are fully recovered, 4 have had slight recurrences with inconsiderable trouble, 3 have had somewhat greater recurrences,

not larger than the palm of the hand at the most as compared with the size of a man's head, prior to the operation. All the patients are fit for work. In no case is there any trouble which might presumably be connected with the introduction of the extraneous ring-mail.

Conclusion. 19 cases with one failure. Of the remainder 15 have been investigated. 8 are fully recovered. 4 have slight recurrences with inconsiderable trouble. 3 have somewhat greater recurrences. All are quite fit for work. The operation has only been performed in really severe cases, and for this reason the results must be judged accordingly. None of the more difficult complications which can be assigned to the foreign transplantaion has occurred. With reference to the operational technique it should be mentioned that cases of recurrences were brought about by the sutures of the ring-mail and edges of the hernial opening, slipping and untying. GOEPEL's advice to allow the netting to reach about 5 cm beyond the edges of the hernial opening should be followed. On the other hand no discomfort has been observed through placing the ring-mail direct on the peritoneum, for which GOEPEL gave warning. The method is to be recommended in cases of large ventral hernias where suture of the ends of the hernial opening is impossible. It can also be applied to advantage when suture takes place under strong tension. The netting relieves the strain on the fascial sutures which otherwise threaten to cut right through. We have preferred this ready-made transplant to the free fascial because, in the case of these corpulent patients fascia lata does not possess the desirable tenacity. Moreover, the operation on the leg is avoided, which can be an advantage when it is a question of fragile patients.

Summary.

After a brief description of the operational methods for the treatment of such large ventral hernias where a direct muscle-fascia suture is impossible, the author gives an account of 19 cases operated with metal wire netting according to GOEPEL. The operational technique is described. The results of 18 cases were wholly or partly successful. One case was a failure because the sutures had cut through, but a renewed operation was declined. Of the remainder, 15 have been found and investigated. 8 were fully recovered. 7 had slight recurrences but of no importance to the working

capacity. The results must be judged with due respect to the fact that the operation was only performed in really extreme cases.

Zusammenfassung.

Nach einer kurzen Beschreibung der Operationsmethoden, die angegeben worden sind für die Behandlung von derartig grossen Bauchwandbrüchen, wo eine direkte Muskel-Fasciesutur nicht möglich ist, berichtet der Verfasser über 19 Fälle, die mit Metalldrahtnetz gemäss GOEPEL operiert wurden. Die Operationstechnik wird beschrieben. In 18 Fällen war das Resultat völlig oder teilweise gut. Ein Fall misslang, da die Suturen durchschnitten; eine erneute Operation wurde doch abgelehnt. Von den Übrigen sind 15 angetroffen und nachuntersucht worden. 8 gänzlich wiederhergestellt, 7 mit kleineren Rezidiven ohne Bedeutung für die Arbeitsfähigkeit. Das Resultat muss mit Rücksicht darauf beurteilt werden, dass die Operation nur in wirklich schweren Fällen durchgeführt wurde.

Résumé.

Après une courte description des méthodes d'opérations indiquées pour le traitement des grandes hernies ventrales pour lesquelles la suture directe de faisceaux de muscles est impossible, l'auteur rend compte de 19 cas opérés avec le réseau de fils métalliques selon la méthode de GOEPEL. On décrit la technique de l'opération. Dans 18 cas l'opération a réussi entièrement ou en partie. Un cas n'a pas réussi parce que les sutures ont traversé, mais on a refusé une nouvelle opération. On a retrouvé et examiné 15 des autres cas. 8 étaient entièrement guéris, 7 avaient de légères récidives, sans importance pour la capacité de travail. Lorsque l'on juge le résultat, il faut prendre en considération que l'opération n'a été pratiqué que dans les cas extrêmement graves.

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A Case of Bilateral Habitual Luxation in the Posterior Part of the Shoulder-joint.

By

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Senior Assistant.

In *Nordisk Medicin*, No. 11, 10th March 1944, HELGE SJÖVALL described a case of "spontaneous posterior subluxation of the shoulder-joint". At the same time he suggests that BLUMENSAAT's classification of the patellar luxations should also be applied to other luxations. This classification distinguishes between: 1. Fresh luxations, arising in direct succession to an adequate trauma. 2. Recurrent luxations which occur more or less "spontaneously" now and then, at longer or shorter intervals. 3. Permanent luxations. These latter are divided into: 3 a. Habitual luxations, where the patella is luxated on every flexion of the knee-joint and 3 b. constant luxations, where the patella never occupies its normal place during any part of the movement of the knee.

According to this classification SJÖVALL's case should be assigned to the habitual luxation group.

SJÖVALL draws certain comparisons between his case and a case of voluntary (habitual-voluntary) posterior luxation of the shoulder reported by ASPLUND in *Acta Chir. Scand.* 1942: 87: 103. SJÖVALL considers that this case described by ASPLUND must be classed as a recurrent luxation (in accordance with BLUMENSAAT's classification).

Both authors consider their cases to be very rare. It might therefore be of interest to give an account of a case of posterior luxation of the shoulder (bilateral), which according to the above classification should belong to the habitual luxation group.

S. A., a domestic servant aged 18, consulted me in September 1944 and stated that on certain movements of the arm she felt a slip in the shoulder, as if the arm had gone out of joint. She had noticed this during several years as regards the left shoulder and for a couple of years in the right. It usually occurred without causing her any inconvenience, but for some time before she came for consultation when she had had unusually heavy work with much scrubbing and washing it had troubled her a little. She had no pains, but quickly got tired in the left shoulder during this heavy work, which constantly involved luxation and reposition. Meanwhile, it was not so much these troubles as the desire to know what was wrong with the shoulders that led her to seek medical advice.

Status ²¹/₉—44. A well-built woman. Inspection of the shoulders reveals nothing abnormal. The muscles of the shoulder and of the upper arm are well developed. When the left arm is stretched forwards and upwards (in the sagittal plane) and is in rotatory middle position or rotated inwards, the caput of the humerus *spontaneously* glides backwards and becomes luxated. It can be palpated under the acromion, while the socket of the joint seems to be empty. X-ray examination of the arm in this position also reveals dorsal luxation of the caput humeri (Fig. 3). This backward movement of the caput proceeds smoothly without any catch, whereas, when the arm is brought back to its original position, the bone returns to its place with a jerk. Luxation occurs most readily when inward rotation takes place at the same time. Thus she can at will produce or prevent luxation when the arm is stretched upwards and forwards on the different planes between the sagittal and the frontal plane, if it is rotated inwards at the same time, but not otherwise. With outward rotation of the shoulder-joint luxation cannot be produced at all.

The right shoulder shows the same tendency to luxation, but not so pronounced.

X-ray examination of the left shoulder-joint reveals nothing abnormal in the bony parts. Fig. 1, Figs 2 and 3 show the shoulder during luxation, taken respectively from the front and longitudinally from the side. The caput humeri is seen to be displaced backwards, out of the socket.

In the case described by SJÖVALL the patient was a powerfully-built man aged 22 who by stretching the arm forwards and upwards during inward rotation could constantly produce backward luxation of the limb. The duration of the condition was two years, with greatly increasing discomfort in the last few months. On X-ray examination the socket and caput were found to be normal. ASPLUND's patient was a young man aged 18. In this case backward luxation of the shoulder-joint could be produced by abducting the right arm to about 50° then stretching it forwards during simultaneous inward rotation. This applied to both shoulders, but mostly to the right. The luxation could

be prevented at will, except when the arm was violently stretched upwards. Otherwise there was a tendency to general laxity of the joint. On X-ray examination there was found a flattening of the posterior part of the glenoidal cavity, while arthrography revealed an insufficiency of the capsular apparatus and an abnormally large posterior recess. These findings were verified on operation and it was further found that the labrum glenoidale was almost entirely absent. The necessary conditions for production of a posterior luxation were here present, but the author has not discussed the actual mechanism of luxation. This has been done, however, by SJÖVALL in his case. He believes that it may be concluded on the basis of X-ray examination and post-mortem experiments that the mechanism of luxation is as follows: On elevation and inward rotation of the arm the tuberculum minus thrusts against the glenoidal cavity, so that the caput humeri is pushed out of the socket and at the same time glides backwards. In order that this may occur the capsule of the joint must be abnormally lax, especially in the posterior part. Thus in post-mortem experiments it was necessary to cut entirely through the capsule (the posterior part thereof) before luxation could be produced. SJÖVALL believes that this same luxation mechanism came into play in the case described by ASPLUND. This assumption finds support in the fact that also here inward rotation was required in order that luxation should take place.

It must be assumed that an insufficiency of the capsular apparatus, especially of its posterior part, must exist in order to make it possible for such luxations as those here described to occur when the caput humeri and the joint-socket are otherwise normal. In my case no arthrographic examination, whereby such insufficiency might have been detected, was made, and neither has its presence been verified by operation; but it must be assumed to have existed. The luxation mechanism itself, however, can hardly be supposed to be such as SJÖVALL conceived it to be in his and ASPLUND's cases. For in my patient luxation can be brought about without inward rotation, namely, when the arm is stretched upwards and forwards on the sagittal plane. It is most easily produced, however, when the arm is rotated inwards at the same time, and this is, as already mentioned, a necessary condition for obtaining luxation at all when the arm is moved forwards and upwards and at the same time outwards towards abduction position. I have imagined the following explanation of the luxa-

tion mechanism:—The more the arm approaches the described position of upward and forward extension with simultaneous inward rotation, the more favourable will be the conditions for production of posterior luxation. For then the outward-rotators, which brace and support the capsule posteriorly, will be lax, since the antagonists are in action and the tendon to the caput longum of the biceps, which acts as an intra-articular supporting ligament, will make least resistance to a backward movement of the caput humeri. On the other hand, outward rotation will hinder luxation. The outward-rotators (*mm. teres minor and infraspinatus*) will then presumably be somewhat braced up, and with them the posterior part of the capsule, even if it is abnormally slack. At the same time the tendon to the caput longum of the biceps will resist luxation.

As regards the etiology in my case, the bilateral occurrence of the condition would seem to point to a capsular insufficiency of congenital origin, an abnormal laxity of the shoulder-joint capsules, which gradually yield to the constant stretchings they are subjected to during physiological movements until they have become so slack that subluxation-luxation may occur without trauma or defect in the capsule. If this assumption is correct, we may expect a further development in the course of time and it must also be permitted to suppose that a joint with such marked dysfunction may afterwards become the seat of arthrosis. Nevertheless, I have not advised the patient to have an operation. It is true that in case of pathological changes in a joint operative treatment is said to be indicated, but to justify such procedure it must be demanded that the condition is really very troublesome and that the operation will be likely to lead to an improvement. For my patient the inconvenience is usually inconsiderable, in spite of the fact that, as regards the left shoulder, the anomaly has existed for many years. Our experience respecting the value of operative treatment for this form of shoulder luxation is small and, as the operation is no insignificant one, I consider it best to defer any such treatment for the time being. In ASPLUND's and SJÖVALL's cases an operation was performed, in the first *ad modum* Eden-Hybinette, in the other *ad modum* Clairmont-Ehrlich, and in both cases good results were noted after observation for respectively $1\frac{1}{2}$ years and 3 months. But in both these cases the condition had entailed so much inconvenience for the patients that operative treatment was indicated.



Fig. 1.



Fig. 2.

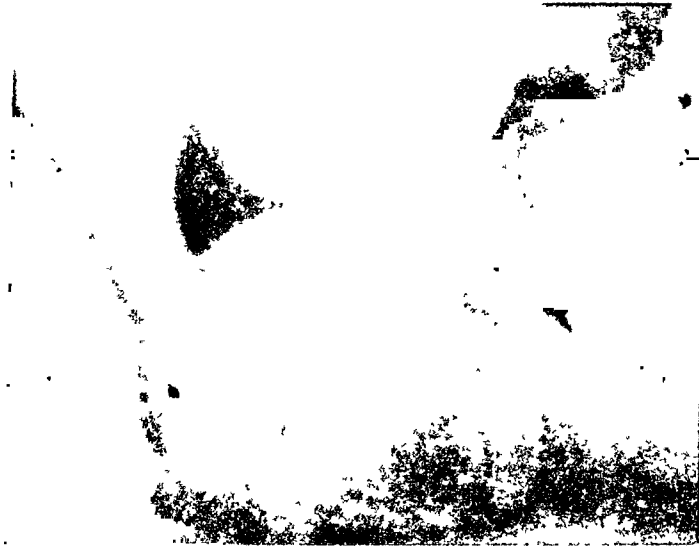


Fig. 3.

Summary.

The author describes a case of bilateral habitual luxation in the posterior part of the shoulder-joint and draws some comparisons with two other cases of posterior luxation of the shoulder, reported respectively by ASPLUND and SJÖVALL. As SJÖVALL's conception of the luxation mechanism does not suit in this case, another explanation is suggested. Biologically the anomaly is here conceived as being due to congenital weakness of the shoulder-joint capsules, which have then during the physiological movements become stretched and relaxed. As the condition in this case had caused only slight inconvenience, operative treatment did not seem to be urgently demanded.

Zusammenfassung.

Es wird ein Fall von doppelseitiger habitueller Luxation nach hinten im Schultergelenk beschrieben, und gewisse Vergleiche werden angestellt mit zwei anderen, von ASPLUND bzw. SJÖVALL beschriebenen Fällen von Schulterluxation nach hinten. Da SJÖVALL's Auffassung von dem Luxationsmechanismus in diesem Falle nicht zutrifft, wird eine andere Erklärung angedeutet. Ätiologisch wird der Fall als durch angeborene Schwäche der Schultergelenkkapseln bedingt aufgefasst, wobei die Kapseln durch die physiologischen Bewegungen gedehnt worden und schlaff geworden sind. Auf Grund der geringen Beschwerden, die der Zustand in diesem Falle verursachte, war eine Behandlung nicht aktuell.

Résumé.

L'auteur décrit un cas de luxation habituelle bilatérale de la partie postérieure de l'articulation scapulo-humérale et fait certaines comparaisons avec deux autres cas de luxation postérieure de l'épaule rapportés l'un par ASPLUND, l'autre par SJÖVALL. Étant donné que la conception de SJÖVALL touchant le mécanisme de la luxation ne saurait s'appliquer au cas de l'auteur, celui-ci propose une autre explication. Du point de vue biologique il conçoit ici l'anomalie comme due à une faiblesse congénitale des

capsules des épaules, qui ont, par la suite, été distendues et se sont relâchées sous l'effet des mouvements physiologiques. L'état des articulations n'ayant, dans le cas en question, causé que de légers troubles, un traitement opératoire n'a point paru urgent.

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Old Clavicular Pseudarthrosis with Late Appearing Neuralgias and Vasomotoric Disturbances Cured by Operation.¹

By
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Pseudarthrosis in fractures of the clavicle is considered to be rare.

LEVANDER, in his Swedish series of 289 pseudarthrosis cases, has no clavicular case.

SVEN KLÆR has two cases of clavicular pseudarthrosis in his Danish series of 44 pseudarthroses, collected in the period 1931—40. Thus a rather high figure. One of these though, is only of 5 month's duration and might possibly prove to belong to the category of delayed union. (Both collections were made on occasion of the two authors' printed introductory lectures for Nordic-Surgical Association's congress in Stockholm 1943. The congress was cancelled.)

BÖHLER speaks of clavicular pseudarthrosis for the first time in "Die Technik der Knochenbruchbehandlung im Frieden und im Kriege", published in 1941. He states that he has only seen them after early instituted energetic passive movements, and following operative treatment.

Pseudarthrosis of the clavicle is in itself not of such great interest, that I would demonstrate a single case. But this particular case offers several points that might interest:

A 39-year-old lady was referred to me in August 1941 for a disease of the shoulder. At the time of birth she allegedly suffered a fracture of the clavicle. At the age of 8 years, she had a dislocation of the left humerus, and at 10 again fracture of the left clavicle. After that the left scapula had protruded a bit — and the left shoulder had hung down and been "shorter" than the right. But she had never felt any pain in it, until she three years ago lifted an old lady who had fainted.

¹ Read in the Oslo Surgical Association 31/1 —44.

Then she felt severe pain in the shoulder, radiating out to the arm. Since then the pain has persisted. At first the pain came on while at work, and continued for a while after. By degrees the pain increased, became permanent, and is described as unbearable and partly keeping her awake at night. The pain is localized to a limited area at the back of the left upper- and fore-arm just proximal to the wristjoint, now and then radiating into the dorsal side of the middle fingers. Tenderness is also present in these areas of the arm, making the touch of clothes intolerable.

During these three years she has gone through all sorts of physiotherapy, and also been resting for months without any result. She had now been unfit for work on account of the pain for a considerable time.

³/₈ —41: *Present state:*

Stoutly built woman. There is a marked atrophy of the left deltoid and also some of the left upper- and fore-arm. Apart from some impairment of pronation the left scapula moves freely. When abducting the arm, she has difficulty in raising it actively above the horizontal level. The head of the humerus is in its normal position.

At the back of the upper arm there is a subcutaneous infiltration, the size of a child's hand, slightly hyperæmic. This area is tender on pressure, but not when lightly touched. At the dorsal aspect of the forearm there is a somewhat smaller, also sharply defined, hyperæsthetic area. These are the areas in which she feels the pain. Fig. 1.

The left clavicle shows an old fracture with considerable angulation. This point is tender on pressure, but pain brought on by pressure does not radiate to the arm.

Horner's syndrome ÷. When the pulse is examined with the arm in various positions no variation in the pulse is found. No paresis.

Fig. 2, x-ray I, shows a fracture at the junction of the middle and outer third of the clavicle with a considerable pseudarthrosis-space, and thickening of the lateral fragment.

As the pain was considered to be due to the pseudarthrosis, one performed in local anæsthesia ²⁵/₁₀ —41:

Resection and Osteosynthesis. 1 cm of the fragments was resected obliquely. As the spongiosa was not exposed by this oblique resection both bone-ends were drilled through longitudinally until the spongiosa was reached. Thereafter osteosynthesis was performed with two parallelogram sutures, one vertical to the other, fig. 3.

After the operation the fragments opposed each other and did not move on moving the arm. The patient was free from pain for 4 weeks. *Then the old pain returned gradually, as before.*

In March 1942 she still had just as severe pain, and she was in despair. Screening demonstrated, according to the radiologist, just noticeable mobility at the point of the osteosynthesis, but no alteration in position. No callus. It was assumed that the steel wire, tied at the back, and newformed connective tissue was the cause of the pain. She was therefore operated on again ²⁶/₃ —42, five months after the first operation. The fracturespace was just visible, there was no callus microscopically. The steel wire was rather loose, and both sutures were removed.

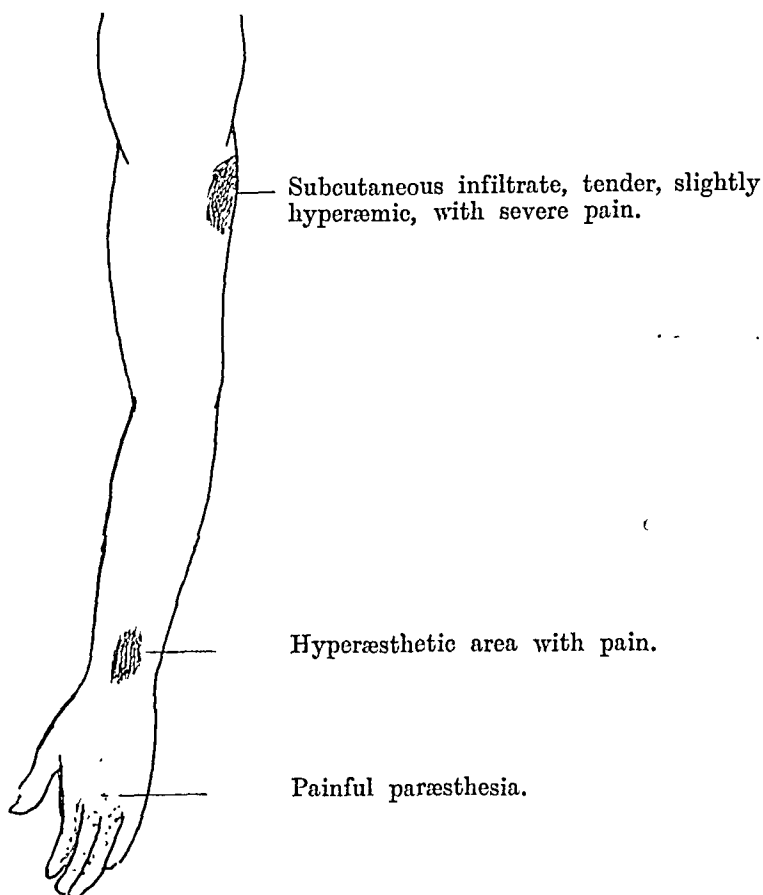


Fig. 1. The hyperæmic infiltrate disappeared together with the pain, after operation.

No movement was visible at the fracture on cautious movement of the arm, even after the removal of the sutures. Consequently only one new, strongly tightened metal suture was placed through fresh drilled holes, as the persistent pull might loosen the union (fibrous?) already present between the fragments. One had no guarantee that a solid osseous union would develop, and therefore a piece of compact bone was chiselled off on each side of the pseudarthrosis, a little separated from it. Thus small openings into the spongy bone were made. A pre-formed tibiagraft with two "bridgeheads" was paced across the pseudarthrosis; the "bridgeheads" fitting on to the exposed areas of spongiosa, fig. 4. Chiselling off more of the corticalis might have made the hold for the metal suture too weak in the already thin fragments. Periosteum and connective tissue was closed with two linen thread sutures and catgut.

Discharged after three weeks — free from pain. She kept the arm in a triangular bandage for 6 weeks.

Fig. 5, x-ray III, 1 $\frac{1}{2}$ months after the operation shows rarefaction

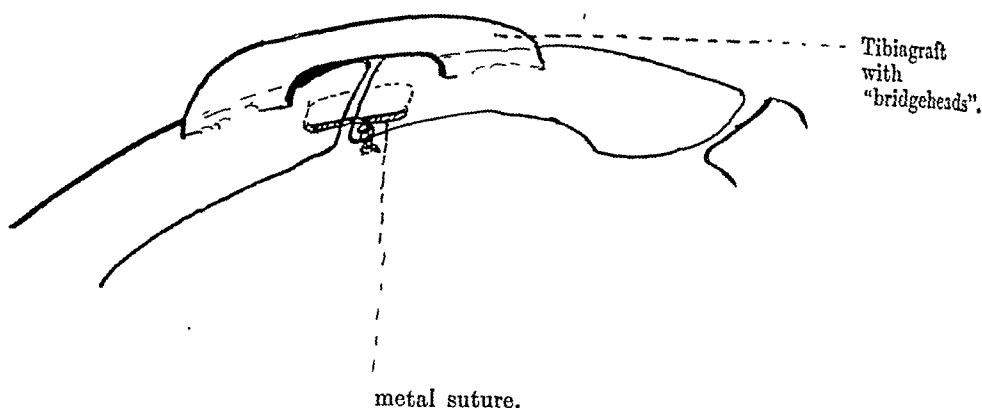


Fig. 4.

of the "bridgeheads", but a minor indication of callus formation at the lateral end of the graft was seen.

Fig. 6, x-ray IV, $\frac{9}{11}$ -42, $7\frac{1}{2}$ months after the operation, demonstrates newformed bone in the bridgeheads.

$\frac{28}{12}$ -42. Mobilisation of the shoulder joint performed under general anaesthesia, without influencing the fracture.

Fig. 7, x-ray V, $\frac{5}{3}$ -43, demonstrates further that the graft has "taken". The last x-ray, fig. 8, $\frac{13}{5}$ -43, $13\frac{1}{2}$ months after the operation, shows apart from the graft "taking" also ossification of the pseudarthrosis cavity, so far as could be judged. The mobility of the shoulder joint improves steadily. She is able to abduct actively to the horizontal level. The old atrophy of the deltoid has of course influenced this movement.

She has been absolutely free from pain for 14 months after the operation now, and one might be justified in the presumption that she is cured for ever. The tenderness at the back of the arm, with rubor and infiltration, has disappeared.

Added later:

$\frac{10}{6}$ -44: On examination she is still without pain, and there is normal mobility of the shoulderjoint. She has been in full work for more than a year.

Summary.

Demonstration of a 29-year-old leftsided clavicular pseudarthrosis. The patient had been without pain for 26 years. Three years prior to examination by the author she developed severe pain in connection with a heavy lift. At first the pain came on while at work, persisting for a while after the work had ceased. Later the pain became approximately permanent and was not influenced by different physiotherapeutic means and x-ray treatments. The pain is characterized as intolerable, and it is localized to sharply defined areas at the back of the upper- and forearm. Subcuta-

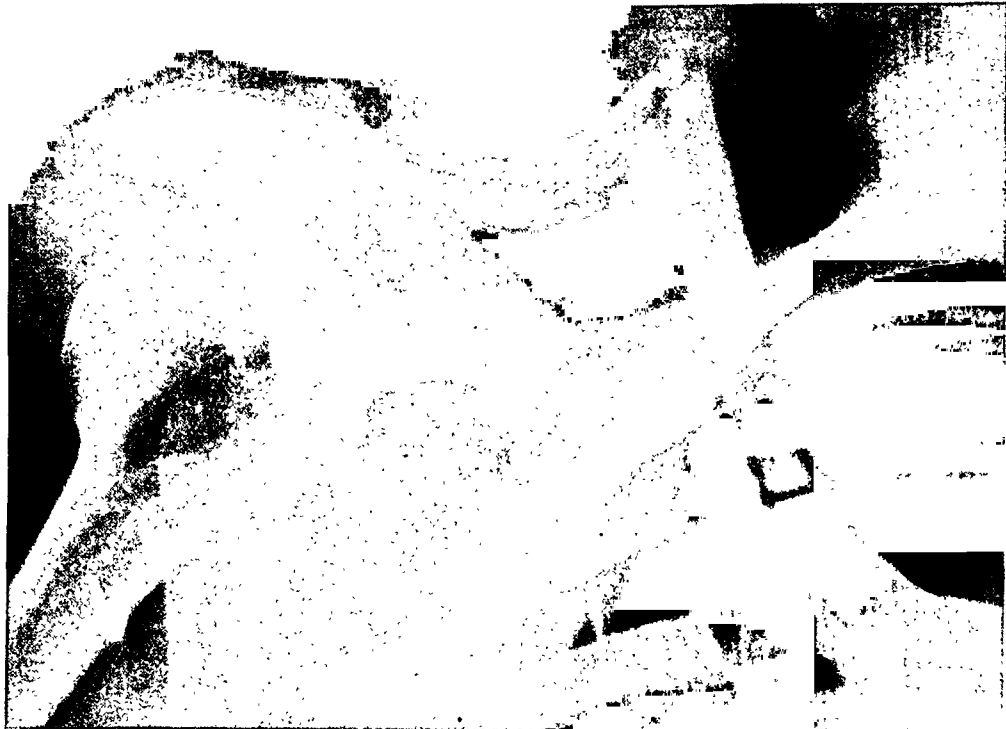


Fig. 2. A 29-year-old clavicular pseudarthrosis that had been painless until heavy lift three years ago.

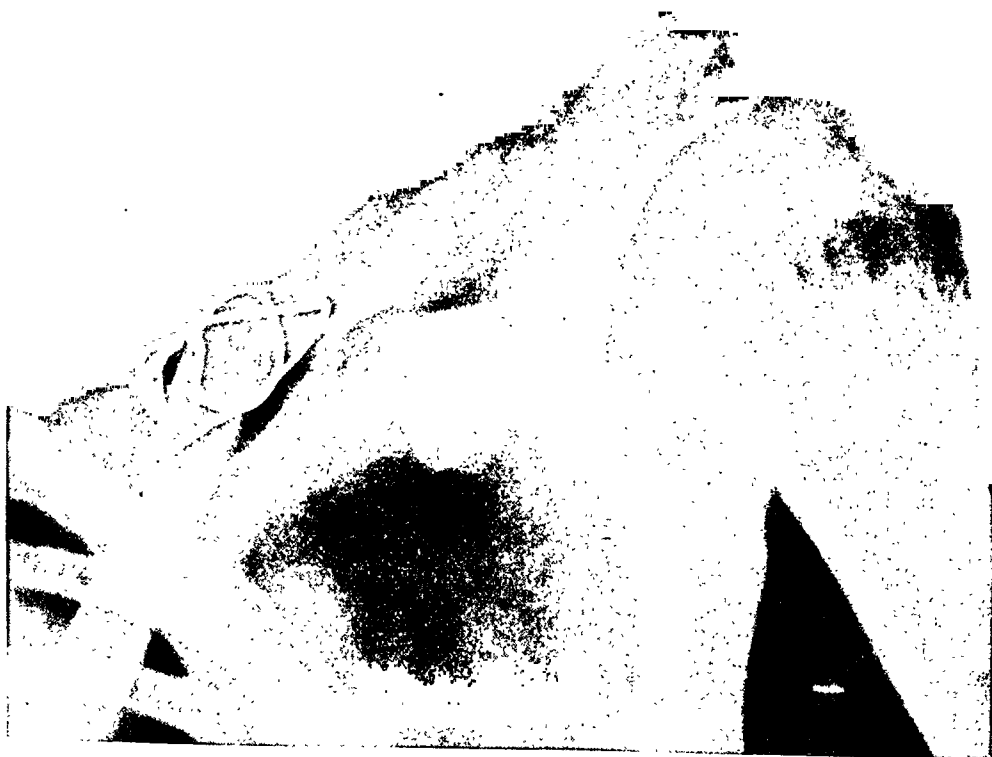


Fig. 3.



Fig 5. Resorbtion of calcium from the "bridgeheads" of the graft (rarefaction), with a minor periosteal reaction at the lateral end of the graft.



Fig. 6 7 1/2 months after the operation. Ossification of the "bridgehead" visible on x-ray.



Fig. 7. 10 $\frac{1}{2}$ months after the operation. A smooth transition between the graft and the clavicle has developed. The cavity of the pseudarthrosis is still visible.



Fig. 8. 13 $\frac{1}{2}$ months after the operation. (The view is a little different from former x-rays.) The graft has taken, and the cavity of the pseudarthrosis is no more visible.

neous vasomotoric changes were found in the former situation, they disappeared after operation of the pseudarthrosis.

After the first operation she became temporarily painless, but the old pain returned in 5 weeks. The steel wire was supposed to press on the plexus, and after its removal the pain again disappeared, consolidation was obtained by bonegrafting.

“Bridging” was used in grafting, metal suture to keep the fragments together, and across a tibiagraft (marrow-periosteum) was placed. The graft was preformed to contact the exposed spongiosa on each side.

Such pain, persistent, increasing, markedly radiating, developing in a 26-year-old clavicular pseudarthrosis, previously painless, might be caused by a sudden contraction of the sternomastoid and the clavicular part of the pectoralis major muscle changing the position of the fragments, resulting in a pull on the plexus through old connective tissue adhesions.

Zusammenfassung.

Demonstration einer 29 Jahre alten, linksseitigen Schlüsselbeinpseudarthrose. Die Kranke war 26 Jahre lang schmerzfrei gewesen. Drei Jahre vor der Untersuchung bei Verf. bekam sie im Anschluss an schweres Heben starke Schmerzen. Zuerst kam der Schmerz bei der Arbeit und bestand nach Beendigung derselben eine Weile fort. Später wurde der Schmerz fast beständig und war durch verschiedene physiotherapeutische Massnahmen und Röntgenbehandlung nicht zu beeinflussen. Der Schmerz wird als unendlich beschrieben und sass in scharf begrenzten Gebieten an der Hinterseite des Ober- und Vorderarmes. An erstgenannter Stelle wurden subkutane vasomotorische Veränderungen gefunden, die nach Operation der Pseudarthrose verschwanden.

Nach der ersten Operation wurde die Kranke vorübergehend beschwerdefrei, doch kehrte der alte Schmerz nach 5 Wochen wieder. Man nahm an, dass der Stahldraht auf den Plexus drückte, und nach Entfernen des Drahtes verschwand der Schmerz wieder. Konsolidation wurde durch Knochentransplantation erzielt.

»Bei der Transplantation wurde ‚eine Brücke‘ verwendet, und Metallsuturen wurden zum Zusammenhalten der Bruchstücke angelegt und quer darüber ein Tibiaspan (Mark-Periost). Die Transplantation wurde vorgenommen, um die blossgelegte Spongiosa an beiden Enden in Kontakt zu halten.«

Solch ein Schmerz (andauernd, zunehmend, ausgesprochen ausstrahlend), der bei einer 26 Jahre alten, früher schmerzfreien Schlüsselbeinpseudarthrose zur Entwicklung kommt, kann durch plötzliche Kontraktion des M. sternocleidomastoideus und der Schlüsselbeinportion des Pectoralis major bedingt sein, wodurch die Stellung der Bruchstücke verändert wird, was zu einem Zug auf den Plexus durch alte Verwachsungen des umgebenden Gewebes führen kann.

Résumé.

Présentation d'une pseudarthrose de la clavicule gauche vieille de 29 ans. Pendant 26 ans la malade n'en avait pas souffert. Trois ans avant l'examen par l'auteur, elle commença à avoir des douleurs vives après avoir soulevé un gros poids. Au début, elles ne se manifestaient qu'au travail, et persistaient un certain temps après sa cessation. Plus tard, elles devinrent presque continues, résistant à divers traitements physiothérapiques, ainsi qu'à la radiothérapie. Elles étaient décrites comme intolérables, et localisées à des régions nettement limitées de la face postérieure du bras et de l'avant-bras. On constata des troubles vasomoteurs sous-cutanés au niveau de celui-là; ils disparurent après l'opération de la pseudarthrose.

Après la première opération, la malade vit disparaître temporairement ses douleurs, mais elles réapparurent au bout de 5 semaines. On pensa que le fil d'acier comprimait le plexus, et après son enlèvement, la douleur disparut de nouveau. La consolidation fut obtenue par greffon osseux.

La greffe était du type en pont, avec des sutures métalliques pour maintenir en apposition les bouts osseux sur lesquels fut placé le greffon tibial (avec moelle et périoste). Le greffon avait reçu d'avance la forme voulue pour être en contact avec le tissu spongieux mis à nu de chaque côté.

Pareilles douleurs de caractère continu, avec une tendance à l'aggravation et des irradiations marquées, se développant dans un cas de pseudarthrose vieille de 26 ans, qui jusque là avait été bien supportée, pourraient avoir été causées par une brusque contraction du sternocleido-mastoïdien et du chef claviculaire du grand pectoral, ayant amené un changement dans la position des fragments d'où serait résultée une traction sur le plexus par l'intermédiaire des anciennes adhérences du tissu conjonctif.

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(Chief: Professor J. HELLSTRÖM.)

Some Aspects of Operative Treatment of Cancer Recti.

By

K. A. HULTBORN.

The material on which the present survey is based comprises all cases of carcinoma of the rectum and anus treated from February, 1940 to September, 1945 at the Surgical Clinic and at the Military Hospital of Karolinska Sjukhuset. To these have been added 5 cases which were treated at the Medical Clinic of Karolinska Sjukhuset and at Radiumhemmet respectively, without having been subjected to operation; nevertheless, it still seems advisable to include them in the present series, in order to establish the actual figure of operability. The total number of cases is 187, of which 11 were carcinoma of the anus. Out of these 122 cases, *i. e.* 65 per cent, have been subjected to some form of radical operation.

The operative mortality and the final results figures acquire greater significance when considered in connection with the operability rate. Thus, for example, in the series of HYBBINETTE, dating, as regards the private clientele, from 1915 to 1935, and, as regards the cases treated at Sabbatsberg's Hospital from 1921 to 1935, the operability rate is 47 per cent, and in GULEKE's series it is 46 per cent. In the material published from the Malmö General Hospital covering the years 1918 to 1943, the operability rate is 32 per cent, in FINSTERER's series of 388 cases, from 1910 to 1940, it is 84 per cent. In a heterogeneous material the figure must naturally be considerably lower, and in the collected material reported by EIKEN in Denmark, 1937, comprising cases observed during the years 1931 to 1935, the operability rate is 27.2 per cent.

Our rather high operability rate is due to our having performed radical operation even in far advanced cases. It will be understood that the cases were of this type, since on an average 8.9 months had elapsed between the occurrence of symptoms and admission to the hospital. In HYBBINETTE's material this period of time had, as regards the private clientele, amounted to 2.8 months, and as regards the cases from Sabbatsberg's Hospital, to 9.7 months. The significance of these figures is manifest from the operability rate in HYBBINETTE's private clientele, viz. 70.5 per cent, and in the other group, 38.4 per cent. In the Malmö series, being, conversely to our own, essentially a city material, approximately 50 per cent of the cases were admitted after more than half a year's illness, and, in the series of FINSTERER, more than half the patients applied for treatment later than after six months. A contributory cause of the cases in our material applying late for treatment is to be found in the fact that no less than 26 per cent had previously sought advice for their symptoms, but had been erroneously diagnosed.

The age of the patients subjected to radical operation is, to a certain extent, an expression of the activity of procedure. The mean age of the radical-operated patients in our series is 59.1 years. In Table 1 is shown the age incidence of the patients who were subjected to extirpation or resection of the rectum. 19.5 per cent were 70 or more years of age, and it is evident from this table, how the mortality rate mounts with increasing age.

Table 1.
Age of the Radical-operated Patients.

Age years	Abdomino- sacral extirpation		Sacral extirpation		Sacral resection		T o t a l	
	Number	Deaths	Number	Deaths	Number	Deaths	Number	Deaths
20 to 29	1						1	
30 to 39	5						5	
40 to 49	17	2	2				19	2 = 10.5 p. c.
50 to 59	28		4	1			32	1 = 3.1 p. c.
60 to 69	33	5	4	1	1		38	6 = 15.8 p. c.
70 to 74	10	3	3	1			13	4 = 30.8 p. c.
75 to 79	7	3	2	1			9	4 = 44.4 p. c.
80 to 85			1				1	
Total	101	13	16	4	1		118	17 = 14.4 p. c.

The recognition of the rectal carcinomatas' spread via the lymphatics is of the first importance in development and choice of operative method. It is above all WESTHUES who has demonstrated the spread through lymphatics. In a material consisting of specimens obtained at operation he in 59 per cent found lymphoglandular metastases. GILCHRIST and DAVID report 68 per cent. In these investigations a special method of preparation was used, which made it possible to examine every lymphatic gland of the specimens. Without our having hitherto examined our specimens systematically for lymphoglandular metastases, such are noted in more than 40 per cent of our radical-operated cases.

The spread through the lymphatics may take place along three channels, partly upwards in the lymphatic system following the branches of the superior haemorrhoidal artery to the main trunk of this vessel, level with or some few centimetres above the promontory. Along this route, whatsoever their localization, all cancers of the rectum are liable to spread, even the anal carcinomata originating from the squamous epithelium and involving the mucous membrane. Such cancers of the rectum as are level with the musc. levator ani may also extend in a lateral direction in the lymphatic system accompanying the middle haemorrhoidal artery to the lymphatic glands adjoining the hypogastric artery. The anal cancers may even spread through the lymphatics following the inferior haemorrhoidal artery and pudendal artery to the lymphatic glands in the groins, and from there to the lymphatic glands situated along the iliac artery. From the lower parts of rectum and anus the spread often occurs along more than one route. A spread through the lymphatics in a retrograde direction is, in operable cases, considered unusual, and according to several investigators it is unusual to encounter tumour cells in the lymphatic system further distally from the rectal growth than one or two centimetres. On the other hand, in the final stage in cases not operated on a retrograde spread in the lymphatics is very often observed, due to blocking of the upper ways.

Simultaneously with cancer of the rectum very frequently polypi in the rectum and sigmoid are found, and WESTHUES reports the rate of 45 per cent. He has demonstrated that these polypi occur in an area extending from 5 cm. below the tumour to up to 30 cm. above it, and that they show a strong disposition toward malignancy.

Because of the invasion through the lymphatics, and of the

above mentioned polypi, one should, in all cases of rectal carcinoma and carcinoma of the anus involving the mucosa, extirpate the rectum above the tumour, a great portion of the sigmoid, the periproctal tissue and mesorectum and also portions of the mesosigmoid, together with the site of the growth, in order to ensure the optimum of radical procedure. Especially in cases of tumours level with the musc. levator ani a generous lateral excision should be done. However, these reasons do not impose resection extending more than at most 5 cm. in the anal direction from the tumours, in order to attain a sufficiently radical procedure.

As to the choice between the sacral (perineo-coccygeal) and the abdominosacral (combined) method, most authors dealing with this question would seem to hold the view that the operation is rendered more radical by the abdominosacral procedure. Still, many surgeons prefer the sacral method in spite of its less radical effect, as this operation does not put the same strain on the patient. Thus, they consider that the lower operative mortality is of greater importance than the consequences of the less radical procedure.

According to our experience, the operative mortality even of the combined method is so low that this procedure should be adopted. We have, however, when dealing with the frailest patients, preferred the sacral method, performing a two-stage operation introduced by GORDON-TAYLOR. The essentials of this method are as follows: At the first stage a colostomy on the sigmoid colon is done, a loop of the bowel being brought out (double-barrelled colostomy). At the second stage, the procedure is purely sacral, the peritoneum being opened and the bowel divided high up and extirpated. The end of the bowel is ligated and invaginated in such a way that a cul-de-sac closed at the lower end is formed, after which the peritoneum is sutured to the bowel, whose invaginated end is hereby brought into an extraperitoneal position.

We have used the combined method in 101 cases, the mortality being 12.9 per cent, and the sacral method in 17 cases, mortality 23.5 per cent. The high death-rate of the latter procedure appears to be due to the cases in question being the least satisfactory of the series, as regards prognosis.

It is a problem of first importance whether, in cases where this is technically feasible, a resection of the rectum with preservation of the anal sphincter should be carried out, or, on the other hand, whether extirpation of the rectum with sacrifice of the sphincter and installation of colostomy should more generally

be adopted. At the Surgical Clinic of Karolinska Sjukhuset the latter procedure has been preferred. The reason for this has been that the operation thus performed was considered to be rendered more radical and less dangerous. In addition, it was hoped to be able to lower the mortality by standardizing the technique. In the Malmö material, with an operability rate of 32 per cent, resection, on the contrary, was favoured, being performed in a little over three-quarters of the radical-operated cases, with a mortality of 30 per cent. In the latter material, extirpation of the rectum was done on patients with tumours located low down and in cases with extensive cancers and gloomy prognosis, the mortality here amounting to 61 per cent. In FINSTERER'S series resection was carried out in 70 per cent with a death-rate lower than that resulting from extirpation of the rectum. The cases subjected to the latter operation were, however, quite exceptionally unfavourable. The mortality for all radical operations in FINSTERER'S series was 20.7 per cent. He is, in view of the danger of insufficiently radical procedures, of the opinion that resection should not be done in cases where the tumour reaches so low down that there is not 5 cm. of normal bowel wall above the sphincter. With merely this limitation, no less than 38 per cent of our rectum extirpations would have been debarred from resection. In FINSTERER'S resection material, primary wound-healing occurred in but 15.7 per cent; and, even if fistulae from the site of resection to a great extent closed spontaneously, it still seems, in spite of FINSTERER'S strong enthusiasm, as if the post-operative course following our extirpations of the rectum had been smoother. O. WANGENSTEEN, on a selected material comprising 24 cases of cancer and 3 cases of ulcerating colitis performed, exclusively from the abdominal cavity, primary resection of the rectal ampulla with a mortality of 7.4 per cent. This method he does not consider advisable in cases of tumours located low down. Neither is it, in his opinion, applicable to tumours located higher up, *i. e.* such as are large and fused with surrounding structures. Similarly, BACON has personally on a selected material carried out radical resection without colostomy in 208 cases, using various methods, with an operative mortality of 7.6 per cent. He recommends BABCOCK'S abdomino-perineal technique of proctosigmoidectomy without colostomy and with preservation of the sphincter muscle. BACON states that improvements and refinements in this technique, such as the establishment of an anterolateral pelvic diaphragm, have pre-

vented descent of small bowel into the perineal wound; precise maintenance of essential blood supply has obviated retraction and necrosis. This procedure has given about 80 per cent continence.

At the follow-up investigation of our material in February, 1945 it was established that the patients were not too seriously discomforted by their colostomy, which we always had installed as an anus iliacus on the sigmoid colon. In those cases disposed towards diarrhoea, the condition can be rendered tolerable by a diet-regimen. In view of the favourable results of resection reported in the American statistical series referred to above, however, it still seems worth considering whether in favourable cases resection procedure in one form or another ought not to be employed.

It is furthermore a highly important question whether abdominosacral extirpation of the rectum should be performed in one or several stages. HYBBINETTE with but few exceptions operated in one stage. Despite the comparatively high operability rate of 47 per cent, he obtained a mortality as low as 19.5 per cent. The division of the operation into several stages, however, appears steadily to have gained ground, and the statistical investigation which more than any other has furthered this development is that of GULEKE, who first operated a series of 30 cases in one stage with 30 per cent mortality. He subsequently reported a series of 100 cases operated in two stages with a mortality of 3 per cent. The interval between the stages was from 6 to 8 weeks. GULEKE considers that the advantages of operating in several stages are not only derived from each operation being rendered shorter and less impairing, but, above all, from the patient's becoming detoxicated by the colostomy done at the first stage. In addition he is of the opinion that the infection at the site of the growth decreases, the danger of infection of the wound cavity and the peritoneum thereby being diminished.

When, in February 1945, our material was surveyed, 34 out of 89 abdominosacral extirpations of the rectum with colostomy on colon sigmoideum had been carried out in one stage with 5.9 per cent mortality, and 55 by two-stage procedure with 20 per cent mortality. Of the latter, 5 had died after the first stage and 6 after the second stage. Among the 50 patients surviving the first stage, the second stage in 33 instances was performed abdominally as well as sacrally, and in 17 cases so great a part of the procedure had been carried through at the first stage that the second stage

could be performed entirely by the sacral route. Between the first and second stages, on an average 52 days had elapsed. Naturally there are more unfavourable cases among those operated in two stages, but we consider, however, that this is not the sole cause of the great difference in mortality. There is no doubt that in many cases the second stage was considerably complicated by adhesions forming after the first operation. In 2 cases these adhesions caused tearing of the stump of the rectum at the second stage, fatal peritonitis ensuing. In another case a peritonitis with fatal issue developed after the first stage originating from the rectal stump. Of the 11 fatalities after two-stage operation no less than 7 are accounted for by infection at the site of operation or by peritonitis. We then considered that the results might be improved by reserving the two-stage procedure for cases with ileus or those that, during the operation, show signs of not being able to endure one-stage procedure. It follows as a matter of course that cases *a priori* regarded as inoperable, but becoming amenable to extirpation of the rectum after colostomy and X-ray therapy, always will have to be operated upon in two stages. On these widened indications for one-stage operation we later, out of 14 radical operations commenced upon, in 11 cases, among which several were unfavourable, performed the operation in one stage without fatalities.

Our present material consists of 101 abdominosacral extirpations of the rectum, 45 of which were performed in one stage with 4.4 per cent mortality, and 56 in two stages, mortality 19.6 per cent (see Table 2). Contributory causes towards our favourable experience with the wider use of one-stage procedure seem to be (i) closer control of fluid, protein and salt balances, (ii) more efficacious shock prophylaxis and therapy, (iii) better means of preventing and treating thrombosis, (iv) the possibility of combating infection with chemotherapeutics, and recently with penicillin, (v) improved methods of anaesthetization.

The reports in literature of the results of two-stage procedures may have been erroneously optimistic in that operable cases that died after the first stage of an intended radical operation were unintentionally transferred to the palliative colostomy group. In order to obtain a correct evaluation of the advantages and drawbacks of a one-stage as against a two-stage procedure, naturally the operable cases ending fatally after the first stage must be included in the group of radical-operated cases.

Table 2.
Material of Cancer Recti and Ani.

<i>Method of treatment</i>	Number	Deaths	Mortality (p. c.)
<i>Combined operation</i>			
Extirpation of rectum with anus iliacus total	101	13	12.9
of which 1-stage	45	2	4.4
" " 2- "	56	11	19.6
<i>Perineo-coccygeal operation</i> . total	17	4	23.5
Extirpation of rectum with anus iliacus	16	4	25.0
Resection of rectum	1	0	0
Total	118	17	14.4
<i>Lesser operations</i>			
Laparotomy + colostomy + extirpation of tumour	1	0	0
Local extirpation of tumour through anus	2	0	0
Local excision of cancer ani	1	0	0
Total of radical-operated	122	17	13.9
<i>Palliative operations</i>			
Anus iliacus sin.	49	2	4.1
Cecal fistula	1	1	
Explorative laparotomy	3	1	
Only stage I of intended radical opera- tion (now under X-ray treatment) .	4	0	
<i>Not operated</i>	8		
Total	187		

Palliative colostomy was performed in 49 cases, the death-rate being 4.1 per cent. In 35 of these cases only a loop of the bowel without division was brought out (double-barrelled colostomy).

The material is of too recent date to allow of drawing any conclusions as to the final results. These will be interesting, as it naturally is a debatable point whether it is worth while to operate in far advanced cases. We have, by way of example, of late even treated 3 cases with liver metastases by extirpation of the rectum. We are of the opinion that these patients are more comfortable on removal of the primary tumour. Moreover, it is known that patients with liver metastases in many instances may live for several years, and it is, therefore, not at all impossible that the life expectancy may be increased by this treatment. The results of the follow-up investigation in February, 1945 are to be found in Table 3. This table shows that no less than 8 patients died of cancer

during the first year after operation. It is, however, to be noted that no death occurred during the first six months following extirpation of the rectum.

Table 3.

Follow-up, in February 1945, of the 89 Patients having survived Combined and Sacral Extirpations and Resections of the Rectum.

Years after operation	Living	Deaths from cancer	Deaths from intercurrent diseases
0 to 1	23	8	
1 to 2	15	6	
2 to 3	7	6	1
3 to 4	12		1
4 to 5	10		

At the follow-up investigation carried out simultaneously among those patients, on whom palliative colostomy had been performed (Table 4), it was found that of 45 who had survived the operation, only 7 still were living. Among these, 27 months was the longest duration of life. The average duration of life for the 38 deceased was no more than 11.6 months. Of the colostomy patients 36 had been treated with X-rays. The low average of life duration among the cases of palliative operations is naturally to some extent due to the fact that this group by reason of our widened indications for radical operation, was deprived of the more favourable cases. Still, we consider this figure as an indication that extirpation of the rectum or resection should be performed still more frequently in far advanced cases, even liver metastases not necessarily constituting a contraindication.

Table 4.

Follow-up, in February 1945, of the 45 Patients having survived Palliative Colostomy.

Years after operation	Living	Deaths
0 to 1	6	25
1 to 2		11
2 to 3	1	2

As to X-ray therapy, we are of the opinion that 12 cases, originally regarded as inoperable, after colostomy and subsequent X-ray treatment were rendered amenable to extirpation of the rectum. It is, of course, difficult to decide to what extent this is due, on the one hand, to the colostomy, or, on the other, to the X-ray therapy. In 3 cases after this treatment the tumour vanished so completely that it was not possible to detect it in the specimen, not even by microscopical examination. In one of these cases, however, malignancy could be demonstrated in a lymphatic gland. It is, therefore, important in cases thus treated first to perform a biopsy, hereby precluding uncertainty as to the actual existence of cancer. However, from such cases there should not be drawn the misleading inference that a radical procedure might be superfluous, as X-ray therapy cannot be expected to affect possible lymphoglandular metastases, even provided that direct irradiation of the primary growth can be achieved by removal of a portion of the sacrum and by division of the rectum.

Summary.

At the Surgical Clinic of Karolinska Sjukhuset during just over 5½ years, 187 cases of carcinoma of the rectum and anus were treated. Out of these 122 cases, *i. e.* 65 per cent, were subjected to some form of so-called radical operation.

In order to render the procedure as radical as possible abdominosacral extirpation of the rectum was generally performed. Only when dealing with the very frailest patients was the sacral route employed, *viz.* according to the GORDON-TAYLOR method. The operative mortality for all radical-operated cases was 13.9 per cent. For the 101 abdominosacral extirpations of the rectum this rate was 12.9 per cent; for the 45 cases out of these operated in one stage, 4.4 per cent, and for the remaining 56 cases operated in two stages, 19.6 per cent. The death-rate among the 17 patients operated by the sacral route was 23.5 per cent.

According to our opinion the abdominosacral extirpation of the rectum should, as a rule, be performed in one stage. The two-stage procedure, however, should be employed in cases with ileus, or in those cases that during the operation exhibit signs of not being able to endure one-stage procedure. In addition, the two-stage procedure is carried out in cases at first regarded as inoper-

able, but, after colostomy and X-ray treatment, becoming amenable to extirpation of the rectum.

The series is of too recent date to allow of any appraisal of final results, but the short duration of life, viz. scarcely one year, for patients treated by palliative operation indicates that extirpation or resection of the rectum should be performed also in far advanced cases, and even if, for example, liver metastases are present.

Zusammenfassung.

In der Chirurgischen Universitätsklinik des Karolinischen Krankenhauses sind in reichlich $5\frac{1}{2}$ Jahren 187 Fälle von Cancer recti et ani in Pflege gewesen. Von diesen ist an 122, also an 65 %, irgend eine Form von Radikaloperation vorgenommen worden.

In der Absicht, den Eingriff möglichst radikal zu gestalten, ist in der Regel die abdominosakrale Rektumexstirpation vorgenommen worden. Nur die gebrechlichsten Fälle sind sakral operiert worden, und zwar nach der Methode von Gordon-Taylor. Die Operationsmortalität sämtlicher radikaloperierter Fälle betrug 13.9 %. Bei den 101 abdominosakralen Rektumexstirpationen war die Operationsmortalität 12.9 %, darunter bei 45 einzeitig Operierten 4.4 %, bei 56 zweizeitig Operierten 19.6 %. Bei den 17 sakral Operierten betrug die Sterblichkeit 23.5 %.

Unserer Auffassung nach ist die abdominosakrale Rektumexstirpation in der Regel einzeitig vorzunehmen. Die Operation soll jedoch zweizeitig ausgeführt werden bei denjenigen Fällen, die einen Ileus aufweisen, oder die während der Operation selbst die Vermutung aufkommen lassen, dass sie einen einzeitigen Eingriff nicht vertragen werden. Ausserdem wird der Eingriff zweizeitig vorgenommen werden in denjenigen Fällen, die primär als inoperabel aufgefasst wurden, nach Kolostomie und Röntgenbehandlung jedoch einer Rektumexstirpation zugänglich werden.

Das Material ist noch allzu frisch, um eine Beurteilung der Spätresultate zu erlauben, doch spricht die kurze Lebensdauer von kaum einem Jahr bei den palliativ operierten Fällen für die Vornahme einer Rektumexstirpation oder Resektion selbst in weit vorgeschrittenen Fällen, sogar wenn z. B. Lebermetastasen vorliegen.

Résumé.

A la clinique chirurgicale de l'Hôpital Carolin, on a traité pendant plus de $5\frac{1}{2}$ ans 187 cas de cancer du rectum et de l'anus.

122 cas, c'est-à-dire 65 %, ont été soumis à l'une ou l'autre forme d'opération radicale.

Visant à une intervention aussi radicale que possible, on a en général pratiqué l'extirpation sacro-abdominale du rectum. Seuls les cas les plus délicats ont été opérés par la voie sacrée, suivant la méthode de Gordon-Taylor. La mortalité opératoire concernant tous les cas d'opération radicale a été de 13.9 %. Celle des extirpations sacro-abdominales a été de 12.9 %; 4.4 % dans les 45 cas opérés en une séance et 19.6 % dans les 56 cas opérés en deux séances. Sur les 17 cas opérés par voie sacrée, la mortalité a été de 23.5 %.

A notre avis, il faut exécuter l'extirpation sacroabdominale du rectum en une séance. Cependant on opérera en deux séances dans les cas d'ileus ou lorsqu'on constate que l'opération en une séance épuise trop le malade. On opère également en deux séances dans les cas que l'on considère d'emblée comme inopérables, mais qui sont susceptibles d'extirpation rectale après colostomie et traitement aux rayons.

Le matériel est trop frais pour permettre une appréciation des résultats éloignés, mais la courte survie d'un an après les opérations palliatives démontre qu'il faut recourir à l'extirpation ou à la résection du rectum même dans les cas avancés et bien qu'il existe par exemple des métastases dans le foie.

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Die Einwirkung von Priscol auf die Heilung von Frakturen.

Von

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Die vorliegende Arbeit soll in erster Linie eine Fortsetzung zu einer früher (1943) von uns publizierten Arbeit über die Einwirkung von lokalen Novokaininjektionen bei der Heilung von Frakturen darstellen.

Die Resultate, zu denen wir dabei gelangten, bestanden darin, dass mit Novokain behandelte Frakturen eine schneller einsetzende Hyperämie als unbehandelte aufweisen sowie dass die Heilung von Frakturen in einem rascheren Tempo vor sich zu gehen scheint.

Die Präparate der Novokaingruppe haben ausser ihrer anästhetischen Wirkung auch ein Vermögen die Blutgefässe zu dilatieren, was auf einer Blockierung, der Vasokonstriktoren beruht. Die Frage, mit der wir uns in erster Linie zu befassen haben ist die, ob die günstige Einwirkung des Novokains auf die Heilung von Frakturen seiner Einwirkung auf die Gefässe oder seiner Anästhesiewirkung, d. h. also der Aufhebung einer Schmerzzustandes der eine Gefässkontraktion in Gefolge hat, zuzuschreiben ist, oder aber inwieweit es sich hierbei um eine Kombination dieser beiden Wirkungen handelt.

Bei dem Versuche, Klarheit hierüber zu gewinnen, haben wir eine Untersuchung von genau der gleichen Art wie die oben erwähnte vorgenommen jedoch mit der Ausnahme, dass wir uns anstelle von Novokain des Präparates Priscol (Ciba) bedienten. Dieses Präparat mit der chemischen Zusammensetzung 2-Benzylimidazolin-HCl, bewirkt sowohl nach oraler wie parentaler Applikation eine kräftige Hyperämie vor allem in den Extremi-

täten und der Haut. Die Hyperämie wird durch eine Gefässdilation, die hauptsächlich den arteriellen Teil des Kapillarsystems, vornehmlich die Arteriolen zu betreffen scheint, hervorgerufen. Die Gefässdilation ihrerseits entsteht dadurch, dass das Priscol den Sympathicus hemmt, wobei sich der Gefässtonus verringert (MEYER 1939, 1941). Trotzdem es hauptsächlich der arterielle Teil des Gefäss-Systems ist, der hier beeinflusst wird, handelt es sich hierbei jedoch keineswegs um einen Stasis-Zustand, was u. a. von MEYER u. MÜLLER (1939) nachgewiesen wurde. Diese konnten nämlich nach Priscolbehandlung eine gesteigerte Durchblutung konstatieren und die hinterher auch klinisch feststellbare Farbenveränderung in der Haut spricht ebenfalls nicht für eine Stasis.

Die grosse Rolle, die die Blutversorgung bei der Heilung von Frakturen spielt, ist seit langem bekannt gewesen, und man hat eine Unmenge von Untersuchungen auf diesem Gebiete vorgenommen. Teils hat man den Effekt von Sympathektomien studiert und teils hat man in der einen oder anderen Form dem Körper Pharmaka zugeführt, die die Gefässversorgung beeinflusst haben.

McMASTER u. ROOME (1935) studierten den Effekt von lumbaler Sympathektomie bei Fibulafrakturen bei Hunden. Als Resultat zeigte sich eine langsamere Heilung als bei nicht sympathektomierten Tieren. Sie prüften auch den Effekt von venöser Stasis durch Ligatur der linken Femoralis. In diesen Fällen verlief die Heilung um 2—3 Wochen schneller. LEXER (1936) fasst die Resultate seiner experimentellen Untersuchungen über die Einwirkung der Sympathektomie auf die Heilung von Frakturen folgendermassen zusammen:

1. Gesteigerte Kallusbildung, die mit der Hyperämie Schritt hält.

2. Eine länger andauernde Hyperämie.

3. Eine länger andauernde lakunäre Resorption der Knochenfragmente und eine daher schlechte Konsolidierung.

Hinsichtlich der Wirkung von Acetylcholin und Histamin haben NEUBURGER und SCHOLL (1935 u. 1937) bewiesen, dass diese keinen Effekt auf die Heilung von Frakturen ausüben, dass sie dagegen aber das Risiko für Ankylose und Muskelatrophie ausschalten oder herabsetzen.

Mehrere andere Arbeiten könnten in diesem Zusammenhang angeführt werden. Zusammenfassend kann man jedoch von diesen

sagen, dass sie bei weitem nicht übereinstimmen. Nach unserer Auffassung liegt eine der Hauptursachen hierzu in dem Umstand, dass die Frakturen, die miteinander verglichen werden, meistens nicht die geringste Ähnlichkeit miteinander aufweisen. In einem Teil der Fälle liegen die Frakturen ideal, in anderen Fällen findet man mehr oder weniger kräftige Dislozierungen vor. Diese können zwischen einer unbedeutenden *ad latum*-Verschiebung bis zu einer ausgeprägten Winkelstellung event. mit Interposition variieren. Die Voraussetzung dafür aber, dass man sich für berechtigt hält, aus Vergleichen Schlussfolgerungen zu ziehen, ist die, dass das Material so gleichartig wie möglich ist.

2. Material und Methodik.

Sowohl das Material wie die Methodik bei dieser Untersuchung soll hier nur in Kürze berührt werden, da sie genau dieselben wie in unserer früheren Arbeit sind und man sie dort in genauer Wiedergabe finden kann. Das Versuchsmaterial bestand aus erwachsenen Ratten, die mit einer hinsichtlich des Vitaminbedarfs vollwertigen Kost gefüttert worden waren. Jede Gruppe enthielt sechs bis acht Tiere. Als Versuchsfrakturen bedienten wir uns supramalleolärer Fibulafrakturen, da man bei diesen durch die Tibia eine gewisse Fixation erhält und daher nicht mit allzu grossen Dislozierungen zu rechnen hat. Durch Röntgenkontrolle haben wir uns davon überzeugt, dass die Frakturen ein gleichartiges Aussehen hatten.

In der ersten Woche nach der Frakturierung bekam eine Serie der Tiere morgens und abends 0.25 cc Priscol intramuskulär eingespritzt. Diese Dosis entspricht c:a 12 mg/kg des Körpergewichts. Man hat bei Hunden einen deutlichen Gefäßeffect des Präparates bei einer Dosis von 5 mg/kg intramuskulär erhalten, sodass uns daher die oben angegebene Dosis als ausreichend erscheint. Während der zweiten Woche nach der Frakturierung haben die Tiere täglich nur noch eine Dosis erhalten und nach der zweiten Woche gar keine mehr. Die Tiere wurden alsdann 6, 10, 14 und 25 Tage nach dem Beginn des Versuches getötet. Zu diesen Zeitpunkten haben wir die Frakturen teilweise histologisch und teilweise — nachdem die Präparate gem. SCHAFFER durchsichtig gemacht worden waren — mit Hinblick auf die Vaskularisierung untersucht.

Resultate.

Ein Vergleich zwischen den Gefässverhältnissen der unbehandelten und behandelten Tiere zeigt folgendes:

6-Tage-Tiere (= Tiere, die nach 6 Tagen getötet wurden): Sowohl bei der behandelten Serie wie bei der Kontrollserie liegt eine mässige Hyperämie vor, die jedoch bei der ersten Serie überwiegt.

10-Tage-Tiere: Die Gefässdichte hat sich nun bei beiden Serien gesteigert. Es liegt jedoch nicht länger ein nennenswerter Unterschied zwischen ihnen vor, wenn auch die unbehandelten Frakturen am meisten von der Steigerung betroffen wurden.

14-Tage-Tiere: Zu diesem Zeitpunkt liegt ein maximaler Unterschied zwischen den beiden Serien vor. Die Vaskularisierung hat sich bei beiden etwas erhöht, jedoch deutlich mehr bei der behandelten Serie.

25-Tage-Tiere: Im grossen ganzen ist keine Veränderung in der Gefässdichte eingetreten.

Das histologische Bild der Frakturen zeigt folgendes:

6-Tage-Tiere: In beiden Serien mässig grosser Kallus. Beide enthalten auch in den gleichen Proportionen reichlich Bindegewebe und Knorpel sowie einzelne Inseln von neugebildeten Knochen.

10-Tage-Tiere: Bei beiden Serien grosser Kallus, der sparsam Bindegewebe und reichlich Knorpel enthält, jedoch ohne einen augenfälligen Unterschied zwischen den Kontrollfrakturen und den behandelten Frakturen. Dagegen kommt in den behandelten Serien eine reichlichere Knochenneubildung vor.

14-Tage-Tiere: Weiterhin bei beiden Serien grosser Kallus, der in mässigen Mengen Bindegewebe und Knorpel enthält. Die Menge an neugebildeten Knochen überwiegt jedoch noch bei den behandelten Tieren.

25-Tage-Tiere: Hier zeigt sich ein augenfälliger Unterschied in der Grösse des Kallus, der bei der behandelten Serie grösser ist. Bei beiden Serien sind praktisch genommen sowohl Bindegewebe wie Knorpel verschwunden. Dagegen weisen die behandelten Frakturen weiterhin eine grössere Knochenneubildung auf. Eine weiter vorgeschrittene Reorganisation kann nicht bemerkt werden.

Discussion.

Die Gefässverhältnisse der Frakturen zu den verschiedenen Zeitpunkten gehen in grossen Zügen aus Abb. hervor. Wie man daraus ersieht, verläuft die Vaskularisierung bei beiden Serien praktisch genommen parallel. Sie hält sich jedoch in der Kontrollserie immer etwas unter den mit Priscol behandelten Frakturen.

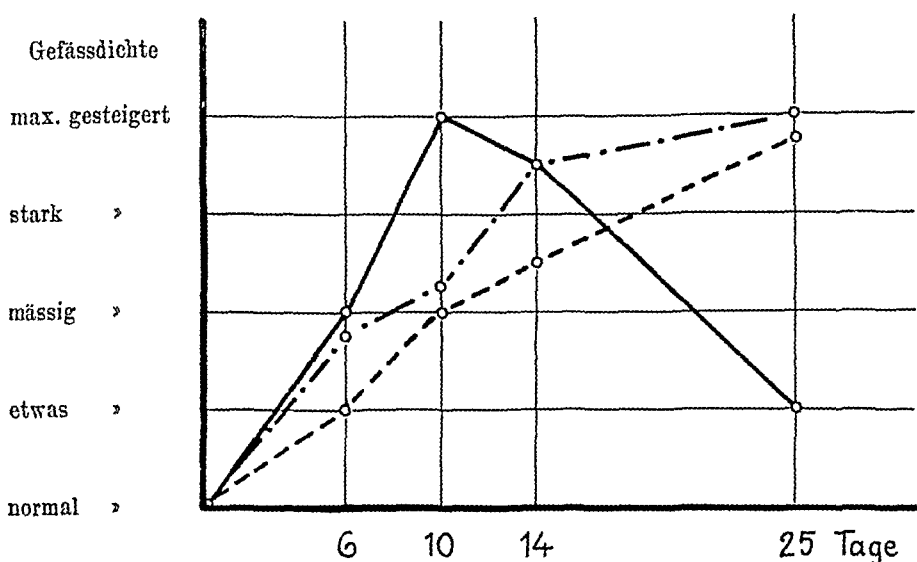


Abb.

- Novokainbehandelte Frakturen.
 - · - Priscolbehandelte
 - - - Unbehandelte

Die, mit Novokain behandelt wurden (Abb.), zeigen teils, dass das Hyperämiemaximum bei diesen zeitiger eintritt als bei denen, die mit Priscol behandelt wurden, teils, dass wir im ersten Falle gleichzeitig mit dem Hyperämiemaximum eine grössere Gefässdichte als bei den letzteren Tiere erhalten, und teils endlich, dass wir am 25. Tage wieder vollständig normale Gefässverhältnisse um die Frakturen erhalten haben. Dies muss nach unserer Meinung darauf beruhen, dass die mit Novokain behandelten Frakturen zum Unterschied von den mit Priscol behandelten zu diesem Zeitpunkt so gut wie vollständig geheilt sind und sich aus diesem Grunde auch die Blutversorgung des Knochens wieder normal abspielt. Nach unseren Versuchen zu schliessen, scheint also das Novokain einen stärker hyperämisierenden Effekt als das Priscol zu haben. Dies kann damit erklärt werden, dass

ein von den Frakturen ausgehender Schmerz-Zustand mit nachfolgender lokaler Gefässkontraktion vorliegt, den das Novokain zum Unterschied vom Priscol eliminiert.

Die Heilung von Frakturen ist direkt proportional mit der Gefässversorgung, was u. a. von LEXER nachgewiesen wird. Am Anfang von Heilungsprozessen ist eine Hyperämie wünschenswert und vorteilhaft. Dauert sie indessen zu lange an, so wirkt sie durch eine gleichzeitige Resorption einer Konsolidierung der Fraktur entgegen. In Übereinstimmung hiermit haben wir nur während der ersten 14 Tage Priscol verabreicht.

Die Heilung der Frakturen hat sich auf folgende Weise abgespielt. Am 6. Tage liegt kein Unterschied im histologischen Aussehen der Frakturen vor, nach 10 Tagen aber enthalten die mit Priscol behandelten Frakturen eine weiter vorgeschrittene Knochenneubildung. Das Vorkommen von Bindegewebe und Knorpel ist dagegen bei beiden Serien ungefähr gleichmässig. Diese gesteigerte Knochenneubildung muss als ein weiter vorgeschrittenes Stadium im Heilungsprozess ausgelegt werden. Die Grösse des Kallus ist praktisch genommen sowohl bei den behandelten wie bei den nicht behandelten Fällen gleichartig, was jedoch nicht bedeutet, dass die Heilung gleich weit vorgeschritten ist. Ein grosser Kallus kann ja lediglich von Bindegewebe und Knorpel bedingt werden. Die Proportionen der verschiedenen Komponenten sind es, die den Ausschlag geben. Nach 14 Tagen sind keine grösseren Veränderungen eingetreten. Am 25. Tage ist bei den behandelten Tieren die Grösse des Kallus augenfällig umfangreicher. Der Heilungsprozess ist jetzt soweit fortgeschritten, das in keiner der Serien Bindegewebe oder Knorpel vorkommt. Im Verhältnis zu der Grösse des Kallus enthalten jedoch die behandelten Frakturen mehr Knochenneubildung. Dagegen ist festzustellen, dass irgendeine Reorganisation in der Form von neugebildeten Markhöhlen u. s. w. weder bei den Kontrolltieren noch bei den behandelten Tieren beobachtet werden kann.

Vergleicht man die mit Priscol behandelten Frakturen mit den mit Novokain behandelten Frakturen, so findet man, dass die letzteren eine bedeutend schnellere Heilung durchgemacht haben. Bereits am 10. Tage kommt bei diesen nur wenig Bindegewebe vor, während man ein reichliches Vorkommen von neugebildeten Knochen beobachten kann. Die mit Priscol behandelten Frakturen wiesen jedoch auch weiterhin Bindegewebe auf, und die Knochenneubildung ist auch nicht soweit vorgeschritten wie bei den

Novokaintieren. Die Frakturen bei diesen Tieren sind nach 25 Tagen praktisch gesehen geheilt, und zwar mit einer weit fortgeschrittenen Reorganisation. Etwas entsprechendes kann bei den Priscoltieren nicht entdeckt werden.

Zusammenfassend kann man sagen, dass die mit Priscol behandelten Frakturen eine gesteigerte Hyperämie und eine etwas schnellere Heilung im Verhältnis zu Normalfrakturen aufweisen. Ein Vergleich zwischen den mit Priscol und Novokain behandelten Frakturen zeigt, dass die letzteren sowohl in der Frage der Vaskularisierung wie der Heilungsgeschwindigkeit bedeutend vor den ersteren liegen. Da beide Präparate eine Sympathicushemmende Wirkung haben, scheint es daher offenbar zu sein, dass das anästhetische Vermögen, das darüber hinaus dem Novokain zur Verfügung steht, diesen Unterschied im Wirkungsgrad bedingt.

Zusammenfassung.

Die vorliegende Arbeit ist die Fortsetzung einer von den Verfassern früher ausgeführten Untersuchung über den Einfluss örtlicher Novokaininjektionen auf die Frakturheilung (BOHM und FLYGER 1943). Die Versuchsmethodik war die gleiche, nur wurde hier ein gefässerweiterndes Mittel, Priscol, verwendet. Es wurde beabsichtigt, die Wirkung einer zum Unterschied vom Novokain lediglich gefässerweiternden Substanz auf die Bruchheilung zu studieren.

Wir sind zu folgenden Resultaten gelangt:

1. Mit Priscol behandelte Frakturen lassen, im Vergleich zu unbehandelten Knochenbrüchen, eine gesteigerte Hyperämie und eine etwas raschere Heilung erkennen.

2. Ein Vergleich zwischen mit Priscol und mit Novokain behandelten Frakturen lehrt, dass die letzteren in bezug auf sowohl Vaskularisierung als auch Heilungstempo die ersteren erheblich übertreffen. Die Ursache hierfür scheint uns die zu sein, dass das Novokain neben seiner Gefässwirkung auch einen anästhesierenden Effekt besitzt.

Summary.

The work consists of a continuation of an investigation previously carried out by the author on the action of local injections of novocaine in the healing of fractures. (BOHM & FLYGER 1943.) The test methods have been the same except that they have

used a vessel-dilating substance — priscol. The idea has been to study the effect on the healing of fractures of a substance differing from novocaine in that it was solely a vessel-diluting one.

The results which we have achieved are:

1. Fractures treated with priscol show an increased hyperemia and a somewhat more rapid healing action as compared with untreated fractures.

2. A comparison between fractures treated with priscol and those treated with novocaine show that the latter, both with regard to vascularization and the speed of healing, is far in advance of the former. It appears to us that the reason for this is that novocaine, in addition to its effect on the vessels, has also an anesthetizing effect.

Résumé.

Ce travail est la continuation des recherches antérieures des auteurs sur l'effet des injections locales de novocaïne sur la guérison des fractures (BOHM et FLYGER, 1943). La méthode expérimentale est restée la même, sauf que cette fois-ci un remède vasodilatateur, le Priscol, a été utilisé. Le but poursuivi était d'étudier l'action sur la consolidation des fractures d'un corps uniquement vasodilatateur, à la différence de la novocaïne.

Voici les résultats auxquels nous sommes arrivés:

1. Les fractures traitées par le Priscol, comparées à celles sans traitement spécial, présentent une augmentation de l'hyperémie et guérissent un peu plus vite.

2. La comparaison des fractures traitées par le Priscol et par la novocaïne montre que celles-ci ont une grande avance sur celles-là, tant du point de vue de la vascularisation que de celui de la rapidité de la guérison. La cause nous en paraît être qu'en plus de son effet vasculaire la novocaïne a une action anesthésiante.

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(Surgeon-in-Chief: V. FOGH-ANDERSEN.)

Harelip and Cleft Palate.

1,000 Patients Submitted to Operation.

By

POUL FOGH-ANDERSEN, M. D.

The operative treatment of harelip and cleft palate is a field of surgery which has gradually become more or less centralized, but which has been referred to widely different special branches within the different countries, chiefly to infant surgery, plastic surgery, and oral surgery. VEAU in Paris, the greatest name within modern harelip and cleft palate surgery, is a general surgeon who has devoted himself entirely to this special branch, but in several places the operations have through a number of years been carried out by infant surgeons, *e. g.* in France (OMBRÉDANNE) and Sweden (EDBERG, HINDMARSH). In most places, however, the operations are carried out by surgeons who have specialized entirely or in part in plastic surgery. This is particularly the case in England (GILLIES, KILNER, McINDOE, WARDILL), Italy (SANVENERO-ROSSELLI), Sweden (RAGNELL), and Finland (FALTIN, SOIVIO). In Germany a great number of patients are treated in the different large oral surgical clinics (AXHAUSEN, ERNST, LINDEMANN, WASSMUND).

In *Denmark*, like in most other countries, the surgical treatment was previously carried out in the various hospitals. Gradually, a number of these operations came to be performed chiefly in the Frederik's Hospital, Copenhagen, and later in the Righospital, besides some other places. We cannot, however, speak of a proper centralisation till Dr. JOHAN ULRICH, who was greatly interested in plastic surgery and infant surgery, began to specialize in harelip and cleft palate operations. A very considerable

number of these operations were then carried out at the public expense in Copenhagen by Dr. ULRICH, at first in Drønning Louise's Børnehospital (Children's Hospital), and later in Diakonissestiftelsen's Hospital. The patients came chiefly from Seeland, Funen, and the other Danish Islands, whereas a great number of cleft palate patients from Jutland were treated by prosthesis in the Jutlandish Cleft Palate Clinic in Aarhus (WARMING, BAGGER).

A possibility opened of an effective centralisation for the entire country after the enactment of "the Social Reform" (law on public aid, law on people's insurance, etc.) in 1933. This centralisation was carried through in the course of the following years at the instigation of H. BERING LUISBERG, Head of the State Institute for Defects of speech, after which the clinic in Aarhus was absorbed in the Institute for Defects of Speech in Copenhagen.

The result of this centralisation was traceable to an ever increasing extent within the years following upon Dr. ULRICH's death in 1934, in particular after the dispatch in 1937 (and again in 1941) of a circular concerning harelip and cleft palate from the Ministry of Social Affairs to all the doctors of the country. In this circular the duty is enforced of reporting all fresh cases to the Invalidity Insurance Court as soon as the deformity is discovered, which generally means immediately after the child's birth. Subsequently the children will be summoned through the State Institute for Defects of Speech for examination in the Institute, with ensuing operation, which is undertaken in Diakonissestiftelsen's Hospital (by surgeon-in-Chief V. FOGH-ANDERSEN), and possibly treatment by prosthesis, which can be carried out either in the Institute for Defects of Speech in Copenhagen or in the Aarhus Department of this Institute. Later on speech lessons are given, which may likewise take place either in Copenhagen or in Aarhus. The treatment of these affections falls under special relief and is generally free of charge. The number of operations for harelip and cleft palate in Diakonissestiftelsen's Hospital has increased considerably after the effectuation of these provisions, so that about 150 patients are treated now every year by one or more operations.

Frequency.

The indications as to the *frequency* of these deformities differ somewhat for the different countries, but it seems in most cases

to be slightly above 1 per mille. Exact statements as to the natal frequency, calculated on the basis of comparatively large numbers of cases, are available from a few countries only (France, PERON, and Germany, GÜNTHER). The most comprehensive Danish investigation so far into the natal frequency was made by P. FOGH-ANDERSEN in 1939 on the basis of a review of birth registers and case histories from the various maternity departments about the country. Among 128,306 births (121,102 live births) there were found 193 cases (175 live births) of harelip and/or cleft palate, *i. e.* 1 to 665 or 1.50 per mille (1.45 per mille for live births). The frequency seems to be slightly higher in Denmark than in most other countries, and the investigation has shown that harelip and cleft palate are here among the most frequent congenital deformities. As stated above, 18 of the children were still-born, *i. e.* 9 per cent, while 22, *i. e.* 12 per cent died within the first 10 days of life.

Since about 80 to 85 thousand living children have been born annually in Denmark within recent years, the annual frequency of cases of harelip and/or cleft palate must be supposed to be about 120, according to the above figures. Owing to the greater mortality among these patients than among normal children (see above) only about 100 can be expected to survive the first critical period. Within the last few years between 90 and 100 fresh cases have been operated on yearly in Diakonissestiftelsen's Hospital (excl. some foreign patients, especially from Norway and Sweden), besides that a few of the broadest cleft palates have been referred to treatment with prosthesis, so the centralisation must be regarded as particularly effective in Denmark.

The frequency is somewhat smaller in the population than at birth, presumably well over 1 per mille, owing to the somewhat increased mortality among children with harelip and/or cleft palate. The number of patients suffering from harelip and/or cleft palate in Denmark is probably ab. 4,000.

Morphologic Classification.

Surgeon-in-chief V. FOGH-ANDERSEN operated on 1,000 patients with harelip or cleft palate from Dr. ULRICH's death on Oct. 1, 1934 till Febr. 1, 1945. The cases have for practical reasons been classified as follows: 1) harelip, 2) harelip associated with cleft palate, and 3) isolated cleft palate.

1) *Harelip* (labium leporinum or cheiloschisis) may be simple or complicated with a cleft in the alveolar process (cheilognathoschisis). Further it may be unilateral, occurring then most often on the left side, or bilateral, very rarely median. Finally it may be incomplete — from a small notch to a cleft that involves almost the whole depth of the lip — or complete, *i. e.* the lip is cleft in its full depth right into the nostril.

2) *Harelip associated with cleft palate* (labium leporinum et palatum fissum or cheilognathopalatoschisis, contingently only cheilopalatoschisis). The harelip may in this group vary to the same extent as in group 1), but it is here associated with cleft palate. In the cases of unilateral harelip with cleft palate the vomer is generally attached to one border of the cleft palate, and always to the side opposite to that on which the harelip is situated. In the cases of bilateral harelip with cleft palate the vomer stands free, anteriorly carrying the premaxillary bone, which then often projects as a lump under and in front of the nose.

3) *Isolated cleft palate* (palatum fissum or palatoschisis) may involve the soft palate alone (staphyloschisis) — contingently only the uvula — or the soft and hard palates (uranostaphyloschisis). The cleft may be narrow or broad, and the palate may be short or long, facts that are of importance when the question of operation or prosthesis is to be decided on, and when the method of a possible operation is to be chosen.

The distribution of the cases within the different groups appears from the following table:

	♂	♀		
Unilat. harelip	151	91	242	} 275
Bilat. harelip	22	9	31	
Median harelip	1	1	2	
Unilat. ha. + cleft palate	241	129	370	} 514
Bilat. ha. + cleft palate	114	30	144	
Cleft palate	77	134	211	
	606	394		
	1000			1000

Besides these 1.000 patients a few cases of rare, atypical facial clefts were submitted to operation within the same space of time, thus for instance 2 cases of cleft of the cheek (congenital buccal

hiatus, macrostomia). No further description will, however, be given here of these rare affections.

It appears plainly from the table that the severe cases of harelip associated with cleft palate are unfortunately by far the most frequent to occur. The relative incidence of the three main groups in the population seems to be approximately 25 per cent harelip, 50 per cent harelip associated with cleft palate, and 25 per cent isolated cleft palate.

A peculiar fact, which is met with in most surveys based on comparatively great numbers of cases, is the typical *sex incidence*. Most statements indicate a considerable preponderance of boys with these deformities; sometimes the ratio is even indicated to be nearly 2 to 1 for boys and girls. Of the entire number of cases here presented 61 per cent are boys and 39 per cent girls. If, however, we regard the individual groups separately it appears that the proportion of boys to girls is not the same within the different types. Besides being favoured by their absolute minority the girls also have a great advantage over the boys from a cosmetic point of view. Thus the girls constitute ab. 20 per cent only of the patients suffering from the severest of all the forms, *i. e.* double harelip associated with cleft palate, whereas they constitute nearly 65 per cent of the patients suffering from isolated cleft palate, the cosmetically most fortunate form. Similar conditions have been found in some of the foreign works (EDBERG, KAMPE et al.); but most often the cases were too few or otherwise unfit for such observations to be made. At least nobody has previously pointed out the more frequent occurrence of isolated cleft palate among women.

Inheritance.

Numerous different theories were formerly advanced as to the *etiology*, such as for instance various diseases or mental shocks suffered by the mother during pregnancy, or amniotic band constrictions. Now, however, most investigators adhere to the theory of inheritance, just like in the cases of various other congenital deformities — at least with regard to harelip with or without associated cleft palate, whereas isolated cleft palate does not always seem to be hereditary. The importance of the hereditary factor appears partly from twin investigations, which show that monozygotic twins are often both deformed, partly from family

investigations, since 30 to 40 per cent of the patients have near relations who present the same deformity. The different forms of harelip and cleft palate do not alternate freely within one family. We have to do here with two different hereditary genes: One gene for harelip with or without associated cleft palate, occurring most often in men, with a manner of inheritance that is generally of a recessive character ("conditioned dominance"); and one gene for isolated cleft palate, occurring most often in women, and presenting a dominant manner of inheritance (P. FOGH-ANDERSEN 1942). The gene may, however, in both cases be present without manifesting itself, so that the usual "Mendelian figures" are not found.

The most important empirical figures for genetic prognosis have been found to be as follows, calculated on the basis of a considerable number of Danish families (ab. 700): If two parents get a child with harelip (+ cleft palate) the chance is about 4.5 per cent for the children to come. If one of the parents presents the deformity in question, the chance is ab. 2 per cent only, as long as they have got no children with harelip, but the chance for the children to come rises to 14 per cent as soon as they have got one deformed child. As to the hereditary form of isolated cleft palate the corresponding figures are ab. 12 per cent, 7 per cent, and 17 per cent. It will be understood from these figures that as a rule there is no need to take eugenic measures. Yet if one of the parents and one or more of the children are deformed, the parents are generally dissuaded from getting more children.

No detailed description will be given here of the *embryological conditions* at the formation of the congenital facial fissures. The classical view of the non-coalesced frontal and maxillary processes is well-known, but is disproved on essential points by modern embryologists supported by VEAU.

The *diagnosis* of these deformities generally follows as a matter of course immediately after birth, but it happens that an isolated cleft palate is not discovered till milk runs out of the child's nose after the child has made some more or less futile attempts to suck. In rare cases a minor cleft in the palate may remain unnoticed for some length of time, generally till the child has attained the age at which it should begin to talk, but has difficulty in making itself understood on account of a pronounced nasal twang. Harelip — at least in its light forms — is chiefly a cosmetic affection,

whereas cleft palate is a severe deformity. The patients are troubled, besides by the difficulties of speech, by a tendency to various complications. The most important of these complications are otitis media and exogenous infections of the air passages.

In some cases (10 per cent or more) children born with harelip and/or cleft palate present *other abnormalities* as well; but in a number of these cases the children are still-born or die shortly after birth, thus in cases of anencephaly, hydrocephalus, spina bifida, and other such severe deformities. Only a few per cent of the children who attain the age at which they are admitted for operation for harelip or cleft palate present other deformities as well, and if they do, it is generally deformities of extremities and defect of intelligence.

Best Time for Operation.

Before a detailed description is given of the operative treatment it should be pointed out that the most favourable *ages for operation*, which are now generally regarded to be about 2 months for harelip and 2 years for cleft palate, were formerly the subject of a great deal of discussion. While most surgeons agreed that the harelip should be operated on within the first months of life, they disagreed with regard to the cleft palate operations. One might be tempted to do the operation at a comparatively late point of time in order to reduce the operation mortality. On the other hand a number of cleft palate patients not operated on must be expected to die of a disease caused by their affection, a fact which argues in favour of early operation, the more so because the patients operated on at an early point of time have from various sides been reported to present better results with regard to speech.

The age of 2 years has been settled as the most favourable time for operation of cleft palates, since the operation mortality is rather high before that age, in particular within the first year of life, and the results of speech become a great deal poorer the later the operation is carried out after this date. The spontaneous mortality has so far been mentioned only as an unknown quantity, so it has not influenced the fixing of the time for operation. At VEAU's instigation I have attempted to fix the mortality rate for cleft palate patients not yet operated on, particularly for children with isolated cleft palate. This should be possible in Denmark where all cases are bound to be reported to the Invalidity Insur-

ance Court as soon as they have been observed by doctor or midwife.

The mortality rate within the first 10 days (12 per cent) is known from the above-mentioned sample of new-born infants published in 1939, which by the way bears out PERON's findings from 1929 in France (13 per cent). There is no essential difference between the three types: harelip, harelip associated with cleft palate, and isolated cleft palate; but it is remarkable that a great number of those who died presented other congenital deformities as well. It would be easy to calculate the mortality rate from the 10th day till the age of operation, if all cases were actually reported immediately after birth, or at least within the first 10 days. The harelip patients are generally reported immediately after birth, so that they can be summoned for treatment at the age of 2 months; but with regard to the isolated cleft palate patients only a small number are reported at once — among others because the diagnosis is often not made till some time after birth. If the present cases submitted to operation are supplemented by the total number of reported cases within the same period (1934—1944), it appears that well over 10 per cent, *i. e.* 25 of the cases of isolated cleft palate were reported within the first 10 days, and 3 of these died before they had attained the age of 2 years, all 3 within the first year of life (12 per cent). The collected mortality rate within the first year of life ("the infant mortality") should thus be nearly 25 per cent, while the "ordinary" infant mortality in the population was about 5 per cent within the same period (according to the Danish Year-Book of Statistics). The statistical value of the stated mortality rate of 25 per cent is in itself rather insignificant on account of the fairly small figures on which the calculation is based, but this percentage accords exactly with the infant mortality rate (ab. 25 per cent) found among relatives with harelip and cleft palate in the above-mentioned family investigation covering 700 families.

Since, however, the cleft palates will hardly ever be submitted to operation earlier than the harelips, the figure which is of practical importance is that indicating the mortality between the ages of 2 months and 2 years for the cleft palate cases reported within the first 2 months. A calculation of the figures in the manner used above shows that 70 of the cases of isolated cleft palate were reported before the age of 2 months, and that 7 of these infants died before the age of 2 years (10 per cent), 5 within the first and

2 within the second year of life. Since the deaths occur chiefly within the first year of life, the cleft palate operations should be carried out at a very early time in order thereby to prevent these deaths to the greatest possible extent. On the other hand the operation mortality is, as stated above, rather considerable before the age of 2 years, particularly within the first year of life, being of a magnitude corresponding almost to the spontaneous mortality for the reported infants, so accordingly there seems to be no indication for operation before the age of 2 years.

Operative Treatment.

At the point of time suited for operation, which means at the age of 2 months for harelip and 2 years for cleft palate, the infants are summoned for *consultation to the State Institute for Defects of Speech* in Copenhagen, where they are examined by the surgeon (surgeon-in-chief V. FOGH-ANDERSEN), the otologist (Dr. JERLANG), the dentist (AA. BLOCH), and the speech therapist (Director BERING LIISBERG). If there is indication for operation at the point of time in question, the patients are admitted to Dia-konissestiftelsen's Hospital. The young infants, *i. e.* those who have not yet been submitted to operation for harelip or harelip associated with cleft palate, are admitted first to the Pediatric Department (Physician-in-chief JOHANNESSEN, M. D.), whereas the cleft palate patients, some of whom have been operated on already for harelip, are admitted direct to the Surgical Department. The young infants are kept under close observation, especially with regard to temperature, hemoglobin percentage, sedimentation rate, and nutritional state, and the operation is postponed if the condition is not satisfactory in every respect. This preoperative control in the Pediatric Department is no doubt of great importance as a means to reduce as much as possible the operation mortality for these 2 months old infants, who are often rather delicate.

The operation is generally carried out in light chloroform anesthesia, which has been found to do the young infants no harm. The anesthetic is first given on an open mask, and is subsequently administered by means of a Juncker's apparatus. Local anesthesia with novocain-adrenalin is applied for older children and adults. In the cases of intraoral operations the child is generally placed

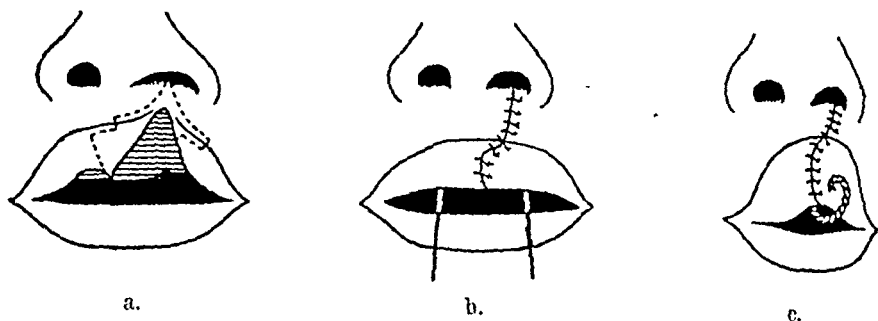


Fig. 1.

a. Incision at operation for harelip.

b. Metal suture inserted from the mucous membrane side, the skin sutured with silk.

c. Overcorrection by tightening of the metal suture.

with its head hanging down beyond the edge of the table and its tongue fixed by means of a silk suture through the apex.

1) As mentioned above, the infant is operated on for harelip at the age of 2 months. The operation was formerly carried out a. m. MIRAULT, a method which aimed chiefly at rendering bloody the edges before they were sewn together, *i. e.* simple labioraphy. The sole technique applied nowadays is one of labioplasty, introduced by VEAU (Fig. 1), the two main principles of which are partly mobilisation of the soft tissue as far as close to the infra-orbital foramen, by which a tension is avoided, and partly dissection of the orbicularis muscle in both lip halves, after incisions along special lines, with ensuing suturing in layers, *i. e.* skin, musculature, and mucous membrane are united separately, by which the muscular ring round the oral orifice is restored. By this method a natural fulness and a normal function of the upper lip are obtained instead of an atrophic, retracted scar with no musculature. The suturing is carried out in the manner that the musculature is caught after the dissection by one or two sub-cutaneous metal sutures inserted from the mucous membrane side and next tightened by twisting, by which a marked, temporary overcorrection is brought about. Silk sutures are made in skin, prolabium, and oral mucous membrane. The sutures are removed 4 to 6 days after the operation. In the cases of double harelip one side is operated on first, and the other 6 to 8 weeks later. If there is a difference between the two sides, the broadest cleft is always treated first in order to avoid too much tension on the second operation. The most important of this new technique a. m. VEAU are the dissection and suturing of the musculature,

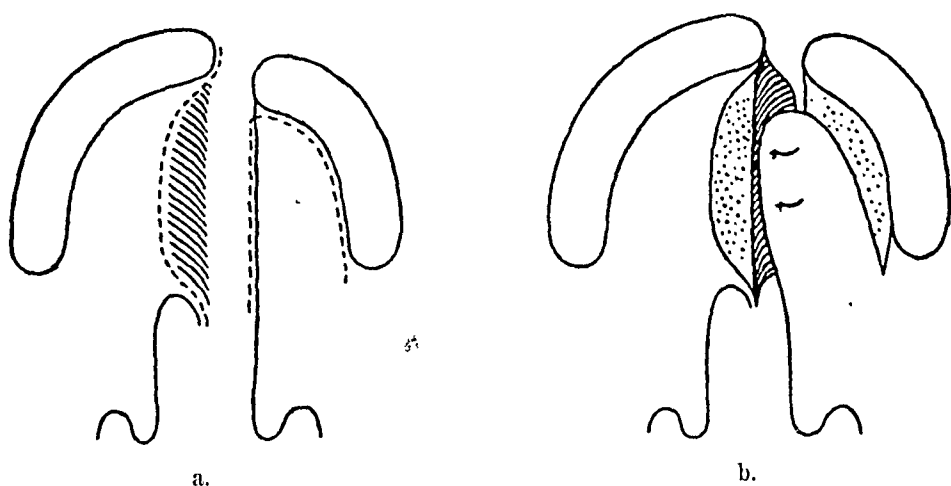


Fig. 2.

a. Incision at the palato-vomerplasty.

b. Palate flap and vomer flap connected by two thorough-going sutures.

features which recur in all subsequent modifications (LUHMANN, AXHAUSEN et al.).

Most important is the treatment of group 2), *harelip associated with cleft palate*, for besides being by far the most comprehensive one, as mentioned before, this group causes the greatest invalidity, in so far as it affects both looks and speech. Finally group 2) is also one of immediate moment, because quite new possibilities for the operative treatment of cleft palate have been created here through VEAU's contributions.

The *unilateral* cases will be described first. The harelip is treated by labioplasty a. m. VEAU in the manner described above. Owing to the great diasthesis between the lip halves the mobilisation mentioned above of the soft tissue is particularly important in the cases of these patients in order to avoid tension. The nostril being generally greatly depressed, the ala nasi is cut free subcutaneously and sutured to the nasal septum. The anterior part of the cleft palate is generally closed simultaneously with the harelip by a special technique, likewise indicated by VEAU (Fig. 2). A muco-periosteal flap is detached from the sloping, free surface of the vomer. This flap, which is adherent superiorly, is everted, so that the bloody surface is turned downwards. An oblong muco-periosteal flap, which is adherent posteriorly, is detached from the lower surface of the free half of the palate to an extent corresponding to the hard palate. This flap can generally be stretched somewhat by detachment of the greater

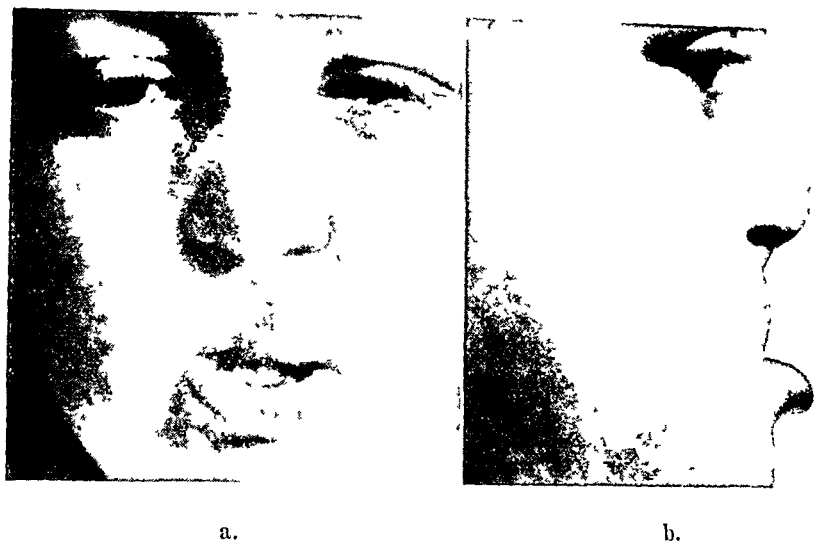


Fig. 3.

a and b. Bilateral harelip and cleft palate admitted for operation of the cleft palate. The harelip treated previously elsewhere after a preceding BARDELEBEN's operation.

palatine artery, after which it is shifted medially, still with the bloody surface turned upwards. The bloody surfaces of these two flaps are connected by means of a few thorough-going sutures. It is possible in most cases first to detach the nasal mucous membrane from the upper surface of the free half of the palate and, after stretching, to suture it to the edge of the vomer flap. This palato-vomerplasty a. m. VEAU leaves a good floor in the nasal cavity, and the cleft is reduced to a cleft in the soft palate, which can generally with facility be closed at the age of 2 years.

As for the *bilateral cases* the harelip is submitted to labioplasty first on one side, generally preceded by palato-vomerplasty as described above, and 6 to 8 months later on the other side. BARDELEBEN's operation, which was formerly so commonly applied, is never used. This operation consisted in a subperiosteal cutting through or wedge-shaped excision of the vomer, which was necessary to avoid the great tension, but which on the other hand caused the upper lip to be completely flat, so that in most cases the profile became very unhandsome with the lower lip protruding like an open drawer (Fig. 3). Nowadays the tension is reduced by the comprehensive mobilisation mentioned above as far as the infra-orbital foramen, and by treating each side separately. The pressure from the soft tissue will, slowly but powerfully, without

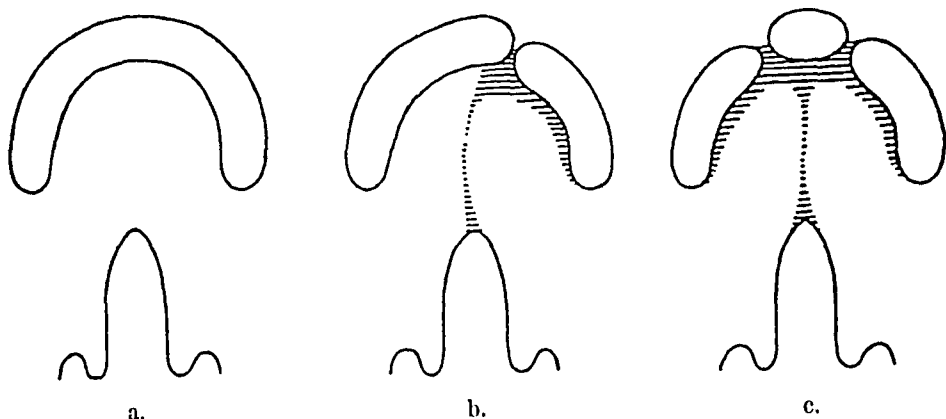


Fig. 4.

- a. Cleft in soft palate, no cleft in lip or alveolus.
- b. Palate in the case of unilateral harelip + cleft palate 18 months after the hard palate has been closed by the palato-vomerplasty and the diasthasis between the alveolar processes has disappeared through the pressure from the upper lip after labioplasty.
- c. The corresponding conditions in the case of bilateral harelip + cleft palate.

further operation, put the premaxilla in place, or perhaps rather inhibit the growth of the vomer.

All the cases of harelip associated with cleft palate are actually transformed through the above operations into pure cleft palate cases involving the soft palate only (Fig. 4). These clefts are therefore also treated exactly like the cleft palates of group 3) by the time the children are ab. 2 years old.

In most cases of harelip operation the healing of the wound proceeds quite smoothly, but as to harelip associated with cleft palate, in particular the severe cases, a second, *corrective operation* is often necessary for cosmetic reasons. This is especially the case with regard to patients who have previously been treated elsewhere by the methods now abandoned. The Invalidity Insurance Court has consented to grant money also towards the treatment of such patients previously operated on, if they are judged to be seriously handicapped in their occupation on account of their disfigured faces. Accordingly an increasing number of these operations have been carried out of late years in Diakonissestiftelsen's Hospital.

These secondary deformities are numerous, so it would lead too far to enter into details in this place. The most frequent deformity is an atrophic scar with no underlying muscular tissue, and displacement of the prolabium on one or both sides of the scar. In some cases there may be a notch with complete absence

of prolabium in the place of the previous harelip, or conversely, there may sometimes be found a projecting flap of skin or prolabium. The nose is often wry and depressed with a large, gaping nostril.

It will generally be possible to improve the looks of the patients very considerably by a comparatively simple corrective operation, if only the tension is not too great and the tissue at hand not too scanty. The method of operation depends of course to a certain extent on the nature of the deformity, but consists nearly always in the first instance in complete excision of the old scar through the entire depth and thickness of the lip, removal of all surplus tissue, dissection of the musculature, and extensive mobilisation of the soft tissue, after which the suturing takes place in the same manner as at the primary operations.

If the tension is great on account of a considerable loss of tissue, more comprehensive operations are often necessary, such as rotation flap from lower to upper lip a. m. ABBÉ, osteotomy on the mandibular ramus in the cases presenting mandibular prognathism etc. Among the different corrective operations that most often prove necessary mention should be made also of the cupid's bow operation a. m. GILLIES & KILNER and the nose-wing-correction a. m. MCINDOE.

Favourable results are often obtained by collaboration with the dentist, who can correct irregularities of misplaced teeth or construct a prosthesis in such a manner that it may advance a retracted upper lip to its normal plane.

Group 3), *isolated cleft palate*, either in the soft or in the soft and hard palates, was previously treated a. m. LANGENBECK, like the clefts in group 2), a method which was extensively used, but which had great disadvantages. The principle being one of mobilizing the muco-periosteal flaps, after some lateral incisions for relief of tension, and next connecting the edges of the cleft, after freshening, by means of a single row of sutures, it is no wonder that the result was often a short, tensioned palate, which did not allow sufficient function of the muscles. The occlusion against the posterior pharyngeal wall was often incomplete, and the results with regard to speech were in many cases poorer than after prosthesis treatment, as appeared also at the presentation of Dr. BAGGER's great number of prosthesis-treated cleft palate patients in Dansk kirurgisk Selskab (Danish Surgical Society) 1929. Within the past 10 years the cleft palates have been treated

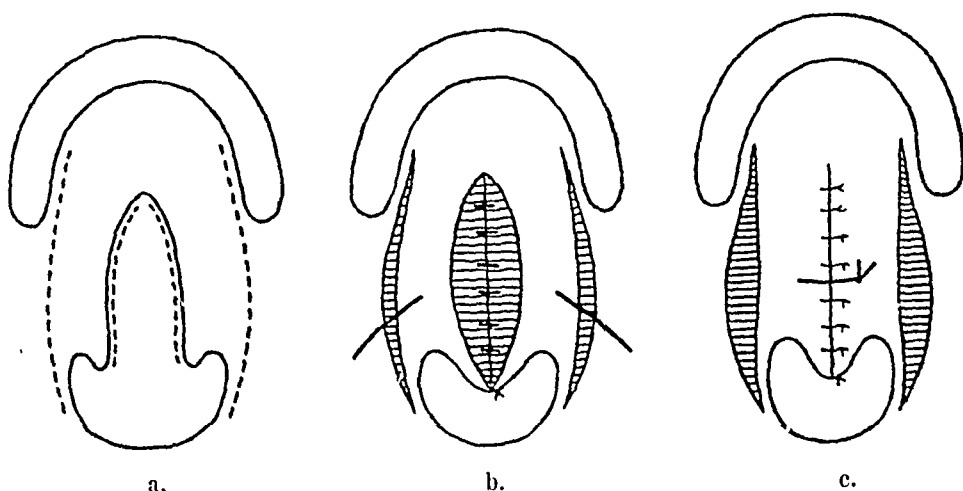


Fig. 5.

- a. Relaxation incisions and incision of edges of the cleft.
 b. Catgut sutures in nasal mucous membrane. The thorough-going metal suture passed through the soft palate from the oral side.
 c. Silk sutures in oral mucous membrane and uvula. Metal suture tied.

in Diakonissestiftelsen's Hospital by a technique which is a modification of a method introduced by ERNST combined with a few of the ideas from VEAU's technique (Fig. 5), which give the method a certain resemblance to the methodics described by AXHAUSEN. The operation is begun by some long, lateral relaxation incisions, which are prolonged posteriorly, so that the lateral pharyngeal wall is detached. In addition the hamular process of the internal pterygoid plate is fractured with a small chisel on both sides. It will now generally be possible, even with preservation of the greater palatine artery, to mobilize the palatal flaps so much that they can meet in the mid-line without tension. Next incisions are made in the edges of the cleft, and the nasal and oral mucous membranes as well as the musculature of the soft palate are cut free. The suturing is made with catgut in the nasal mucous membrane, and with silk in the oral mucous membrane and the uvula; and a broadly thorough-going metal suture is inserted through all the layers of the soft palate in order to fix the musculature in this part of the palate. The metal and silk sutures are removed after 6 to 8 days.

There is but rarely indication for a secondary cleft palate operation in the cases in which an earlier operation a. m. LANGENBECK has led to a more or less unsatisfactory result. Sometimes it is a question of closing a small hole, but generally treatment

by obturator must be recommended in the cases of a poor functional result, contingently after a preceding transection of the velum palatinum.

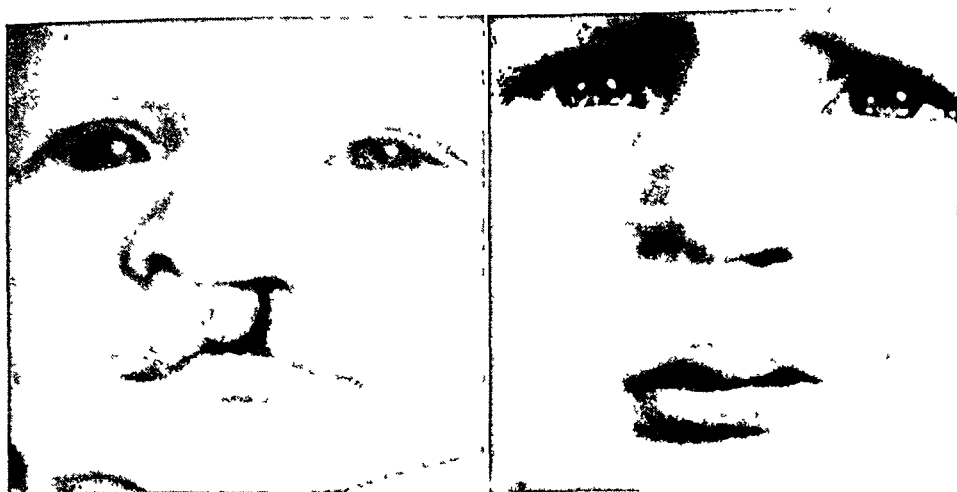
Results.

As to the *results* of the harelip and cleft palate operations carried out within the past 10 years we must still speak with some reserve with regard to those of the cleft palates. Even though the anatomical result is generally satisfactory, with a vaulted, long palate and a freely movable velum, the same need not necessarily be the case with the functional result. Nothing can be settled with regard to the functional result until the patients treated according to the modern technique of operation have attained the age (8 or 9 years) at which they are summoned for speech-training to the Institute for Defects of Speech. The number of these patients is of course as yet comparatively small. As for the harelip operations, which aim chiefly at improving the looks, the result can be ascertained at a far earlier point of time. Photographs are taken of all the harelip patients in Diakonissestiftelsen's Hospital both before the operation, and if possible, also 1 to 2 years after.

Survey of cases submitted to operation:

Number of patients		Operated on for harelip	Deaths	Operated on for cleft palate	Deaths
1)	242 with unilat. harelip	242	6	—	—
	31 » bilat. harelip	31	3	—	—
	2 » median harelip	2	0	—	—
2)	370 » unilat. ha + cl. pa...	319	8	246	3
	144 » bilat. ha. + cl. pa...	132	14	80	0
3)	211 » cleft palate	—	—	211	0
1000 patients		726	31	537	3

In the following further details will be given of the course and the results within the different groups. First group 1), *i. e.* harelip with no associated cleft palate: Of the 275 patients treated here 249 were "fresh" cases, *i. e.* infants not previously operated on, most of them between 2 and 3 months old. 9 of these latter patients died: 4 died in hyperpyrexia from 1 to 3 days after the



a.

b.

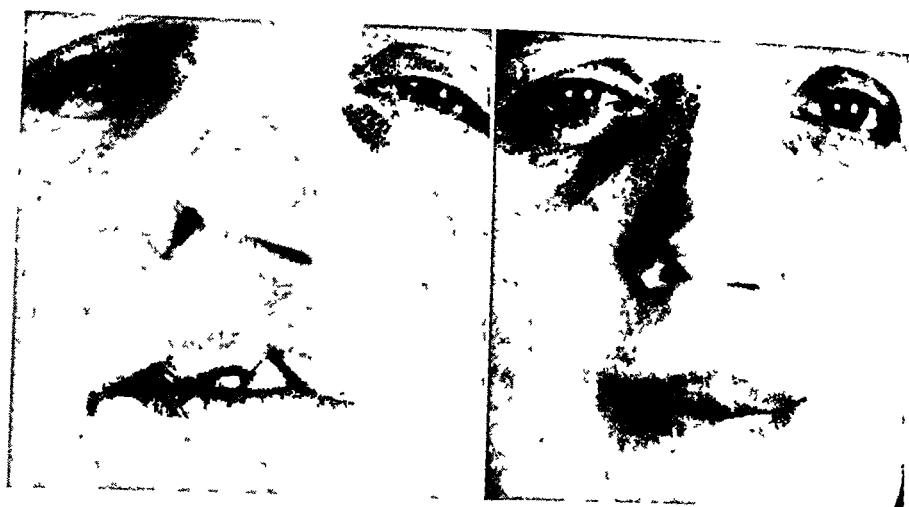
Fig. 6.

a. Unilateral harelip, complete with alveolar cleft, but without cleft palate.
 b. 2 years after labioplasty a. m. VEAU.

operation, and 3 developed pneumonia in connection with the treatment and died from 4 to 10 days after the operation. The remaining 2 patients died of intercurrent diseases 3 and 9 weeks respectively after the operation (ileus, pneumonia). In a single case the wound burst completely, but re-operation was done with a perfectly satisfactory result. In the remaining 239 cases the result was rather favourable from a cosmetic point of view after the first operation (Fig. 6). A small number went, however, later through minor corrective plastic operations, consisting chiefly in excision of a little surplus prolabial tissue.

26 of the 275 harelip patients had previously been operated on elsewhere, and had now been admitted for corrective plastics. The wounds healed up to satisfaction in all cases (Fig. 7), and no deaths occurred.

As to group 2) the two subgroups will be dealt with separately. The former, *unilateral harelip associated with cleft palate*, comprised 370 cases, 270 of which were "fresh". 8 of the latter died after the harelip operations, which took place chiefly about the age of 2 or 3 months: 1 died the day after the operation from aspiration of alimentary vomit, 2 died in hyperpyrexia 2 or 3 days after the operation, and 2 developed pneumonia in connection with the treatment and died 3 and 8 days respectively after the operation. The remaining 3 patients died of intercurrent



a

b.

Fig. 7.

- a. Unilateral harelip. Patient treated elsewhere in infancy, admitted for corrective plasty. Highly disfiguring scar, pronounced notch with complete absence of prolabium.
- b. One year after corrective labioplasty.

diseases from 3 to 6 weeks after the operation (empyema, pneumonia). In one case the wound burst completely after the first and the second operations, and in part after the third; 4 attempts had to be made before the lip could hold. Another lip likewise split after the first operation, but healed up after re-operation. In all the remaining cases the lips held after the first operation (Fig. 8 and 9), and the results were as a rule cosmetically satisfactory; in some cases, however, a greater or smaller defect could be seen along the line of suture, generally at the border of the prolabium or in the nostril, and sometimes the affected nostril was too wide and flat. A number of these cases were subsequently submitted to corrective plastic operations.

The remaining 100 of these 370 patients had previously been operated on elsewhere (70) or by Dr. ULRICH (30) for harelip, and in a few cases for cleft palate as well. They had now been admitted for re-operation of the lip or the palate, or for closure of the untreated cleft in the palate. 58 of these patients were submitted to corrective plastics of the lip, and these operations were all completed without complications of any kind, in most cases with a cosmetically favourable result.

The other subgroup, *i. e.* that of *bilateral harelip associated with cleft palate* comprised 144 patients. 118 were harelip patients not

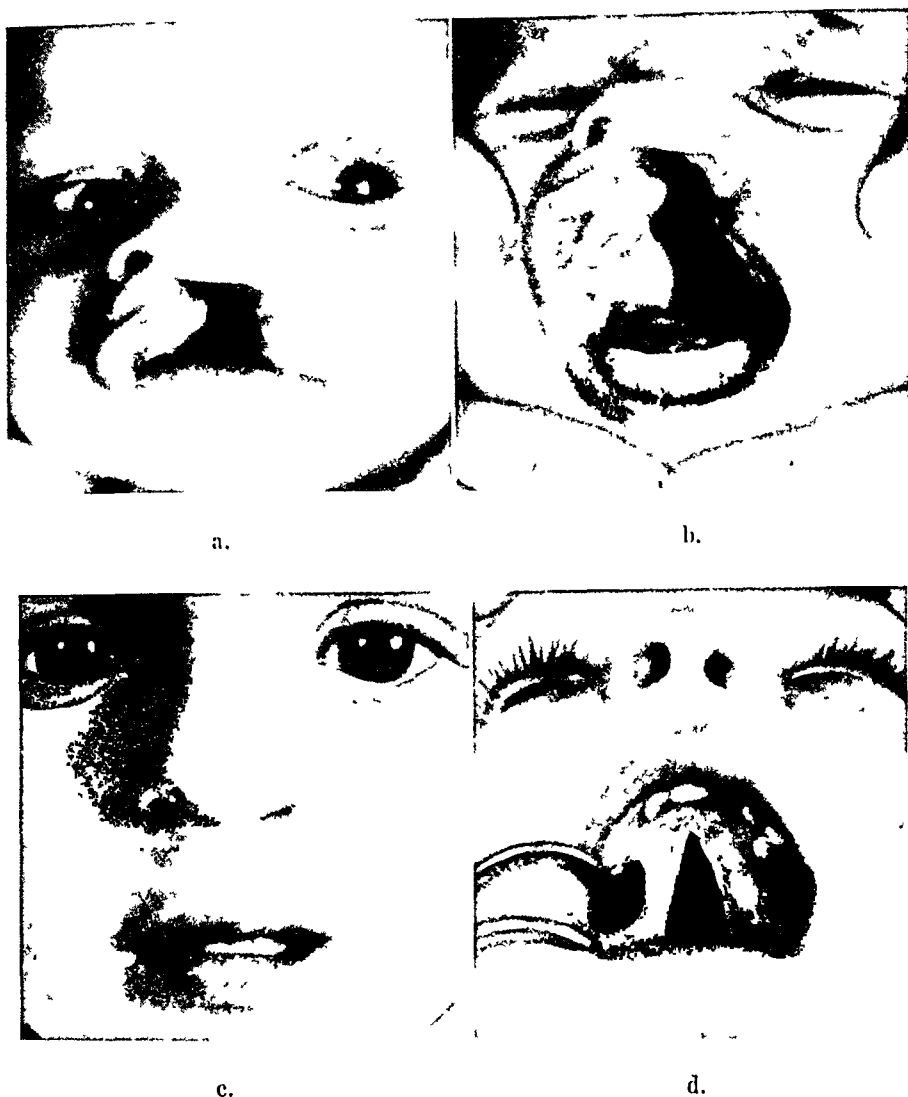


Fig. 8.

a and b. Unilateral harelip and cleft palate.

c and d. 18 months after labioplasty and palato-vomerplasty.

previously operated on, chiefly infants aged 2 to 4 months, who were submitted to 2 operations with an interval of 6 to 8 weeks. 14 of these latter patients died: 1 patient collapsed during the second operation and died half an hour later, possibly on account of overdosage of chloroform, 1 died the day after the first operation (congenital debility, persistent foramen ovale — autopsy), 4 died in hyperpyrexia from 1 to 3 days after the second operation, 1 developed an abscess in the upper lip and died 4 days after the second operation in hyperpyrexia. The remaining 7 patients died

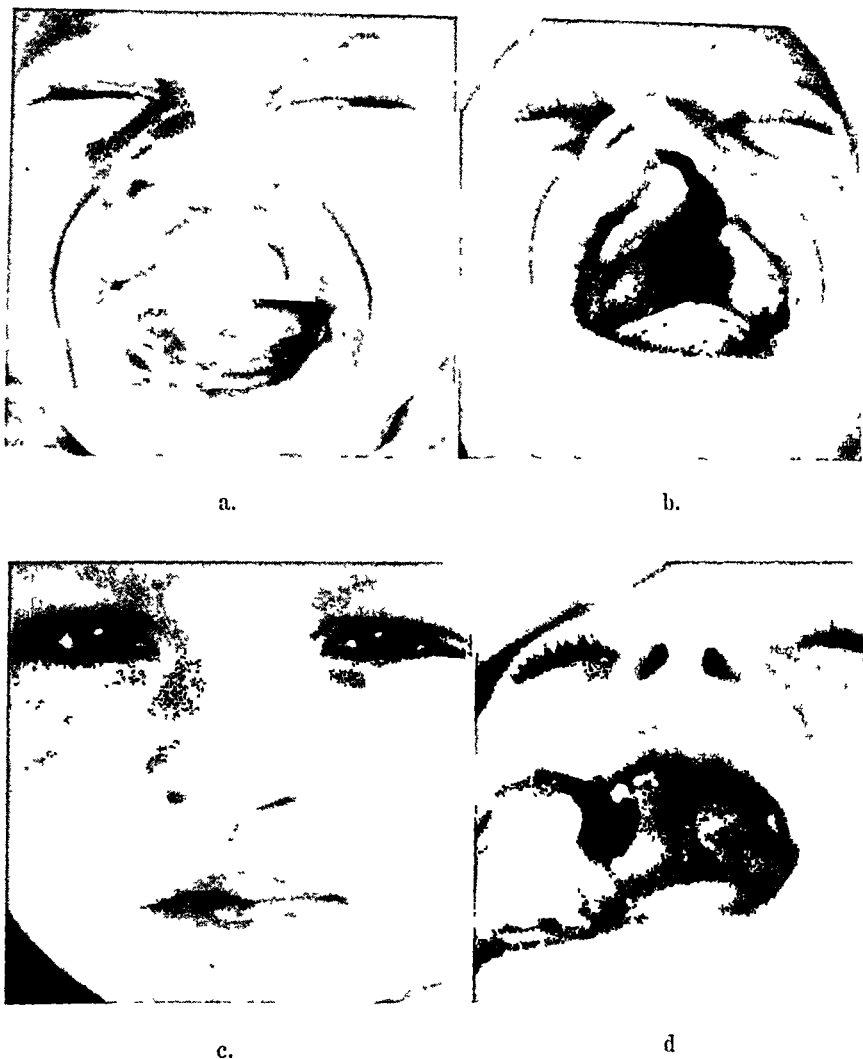


Fig. 9.

a and b. Unilateral harelip and cleft palate.

c and d. 20 months after labioplasty and palato-vomerplasty.

from 5 to 11 weeks after the operation (6 after the first and 1 after the second operation) of intercurrent diseases (septic nasopharyngitis, bronchitis, pneumonia, pyuria) which had probably no connection with the operation. The wound burst entirely or in part in 9 cases on account of the great tension, but in all these cases satisfactory results were obtained by repeated operations. The remaining clefts healed up satisfactorily after the first operation (Fig. 10) or were subsequently submitted to corrective plastic operations.



Fig. 10.

a, b, and c. Bilateral, complete harelip and cleft palate with projecting premaxilla.
 d, e, and f. 18 months after labioplasty and palato-vomerplasty a. m. VEAU.

26 of the 144 patients had previously been operated on elsewhere (19) or by Dr. ULRICH (7) for harelip, and in some cases also cleft palate. 19 patients were submitted to successful corrective plastics, in most cases with a fully satisfactory result from a cosmetic point of view.

As for the *cleft palate operations* of group 2), i. e. uni- and bi-lateral harelip associated with cleft palate, it is surprising to see the difference it makes with regard to the possibility of obtaining a favourable result, whether the above-mentioned palato-vomer plasty a. m. VEAU has been carried out in advance simultaneously with the harelip operations. If this operation has not been done, it is often difficult to obtain a primary closure of the hard palate owing to the width of the cleft, and some of these patients are therefore referred to treatment with prosthesis instead. If on the other hand this preliminary operation has been carried out at the age of 2 months the cleft will have become so much narrower and shorter by the age of 2 years that it will nearly always be possible to carry through the palatoplasty itself without difficulty, and the percentage of healing will become greater. 3 of the 326 patients submitted to the cleft palate operations of group 2) died after the operation: one of hemorrhage 12 hours after the operation, one (a Mongolian idiot) of hyperpyrexia scarcely 24 hours after the operation, while the third patient died 3 weeks after the operation of an intercurrent influenzal pneumonia.

None of the 211 patients operated on for isolated cleft palate (group 3)) died after the operation. Primary healing was obtained in the great majority of these cases. In a few cases the wound burst entirely or in part after the operation, but it healed up again after renewed palatoplastics.

Deaths.

With regard to the *mortality rate* for harelip and cleft palate operations we cannot count direct on the figures of the table p. 226 (4.3 per cent for the harelip patients and 0.6 per cent for the cleft palate patients). This is among others due to the fact that the corrective plastics, which are most often carried out on adults or great children in local anesthesia, must be regarded as harmless, having, as mentioned above, given rise to no deaths in the cases here presented. On the other hand the 34 deaths comprised

some (13) that occurred 3 weeks or more after the operation and were caused by intercurrent diseases which generally developed after healing of the wound and removal of the sutures, and which must be supposed to have had no bearing upon the operation. It should be stated in this connection that 9 infants not operated on died of similar diseases within the same period. Finally it must be remembered that infants presenting bilateral harelip associated with cleft palate are submitted to 2 operations with an interval of 6 to 8 weeks. When these facts are taken into consideration it appears that 19 deaths occurred in direct connection with or as a likely consequence of primary operations for harelip, of which 775 were done, and that only 2 out of 537 cleft palate operations proved fatal. This means that the mortality rate must be calculated to be between 2 and 3 per cent for harelip operations and scarcely $\frac{1}{2}$ per cent for cleft palate operations, figures which correspond exactly to those of the more comprehensive foreign statistical works from recent years.

On looking further into the causes of death we find that *hyperpyrexia* is the most frequent "cause" of death in direct connection with the operation. Pure hyperpyrexias, *i. e.* cases in which no focal infection could be demonstrated clinically, occurred in 11 cases. This peculiar complex of symptoms has previously been the subject of considerable interest, but no proper explanation has been given so far. The course was characteristic: all 11 cases presented a continual rise in temperature and terminated fatally 1 to 2, or 3 days at most after the operation. The French term for this complex is "mort rapide avec pâleur et hyperthermie" (OMBRÉDANNE), since a striking paleness, occasionally accompanied by a slight cyanosis are typical features.

Post-mortem examinations of hyperpyrexia patients have revealed nothing remarkable. HEERUP has, however, described a number of cases with a similar course under the name of "Toxaemia tonsillopulmonalis fulminans infantum", and on autopsy demonstrated an excessive growth of bacteria in tonsils and lungs. Nevertheless there can hardly be any doubt that deaths due to hyperpyrexia on a non-infectious basis really do occur. Thus cases have been described in which hyperpyrexia developed in direct connection with an unbloody redressement of clubfoot and the like.

While OMBRÉDANNE indicates the ages from 6 days to 6 months to be the most critical period as regards postoperative hyper-

pyrexia, the age at which the harelip patients of the present investigation were most exposed seems to have been somewhat higher. Only 3 of 10 deaths due to hyperpyrexia occurred within the large group of harelip operations (ab. 80 per cent) carried out before the age of 5 months. The remaining 7 deaths occurred within the smaller group of somewhat older infants, and here in particular after the second stage of operation for bilateral harelip associated with cleft palate, an experience which was made also by VEAU. Among the cleft palate patients, who were nearly all of them 2 years old or slightly older, the occurrence of death due to hyperpyrexia was extremely rare, *i. e.* 1 to 537 (a Mongolian idiot aged 3). VEAU on the other hand experienced 13 deaths among 500 patients; indeed, only one was over 2 years of age and only one under 6 months. As for the remaining 11 cases the relative frequency of death was the highest between the ages of 6 and 12 months. It is hardly possible to give an explanation to this apparently greater chance of developing hyperpyrexia immediately after the age of 5 or 6 months decreasing towards the age of 2 years. A reduced resistance to infection within this age-class (MAALØE) is possible; but on the other hand a great number of the hyperpyrexias may not have been infectious, and in the remaining cases of death among the present harelip patients (among which a number of deaths unquestionably due to pneumonia) there seems to have been a parallelism between the age incidence of deaths and that of operations (15 out of 21 deaths occurred before the age of 5 months).

That an essential feature of the hyperpyrexia syndrome is a disturbance of the heat regulation with a reduced power of emitting heat appears from the fact that it is possible in some cases to save children who are on the way to high temperatures by placing them in a cold bath ($17^{\circ}\text{C} \approx 63^{\circ}\text{F}$), as indicated by AAGE NIELSEN. Within recent years a few of the children from Diakonissestiftelsen's Hospital have recovered after this treatment. In one case it was necessary to give repeated baths of 17°C for 3 to 5 minutes before the temperature fell sufficiently. Time will show to what extent this treatment can be regarded as efficient.

It is probably advisable, as a prophylactic measure against the postoperative hyperpyrexias, to finish the operations on the harelip patients as far as possible before the age of 5 or 6 months, and not to operate on the cleft palate patients till about the age

of 2 years. Further it is no doubt of importance that the infants are not wrapped up in too warm clothes after the operation, and, besides, that they are carefully watched over, so that action can be taken in time, if the temperature rises alarmingly.

The mortality rate for the *cleft palate operations* is, as stated about, extremely small (ab. $\frac{1}{2}$ per cent). The percentage is in reality so small that we must be justified in taking no particular account of it when the question of operation or prosthesis is to be decided on in a given case, at least if the operations are not carried out till about the age of 2 years. The facts to be considered in this connection are partly the possibilities of a really favourable functional result, partly, and not the least so, the practical fact that it is a great advantage for the patient not to have to wear a prosthesis for the rest of his or her life, even if speech is possibly faultless with a prosthesis. Accordingly it is now only a few of the longest and broadest cleft palates with very scanty soft tissue on the sides that are referred primarily to treatment with prosthesis (a total of 6 cases within the past 4 years, in 2 of which the treatment was due chiefly to the parents' resistance to having their child operated on).

As pointed out before, nothing certain can be stated as yet with regard to the *functional results* after the cleft palate operations carried out according to the modern technique. VEAU's principles were not introduced till 1936. This means that the first patients with harelip and cleft palate treated by palato-vomer plastics had their soft palates operated on about 1938 at the age of 2 years. Such patients are summoned for speech-training partly at the age of 8 or 9, and partly again at the age of 13, and it is not till then that the final result can be judged of. Thus it is only about one year since the first cleft palate patients operated on entirely according to the modern technique were given their first series of speech lessons, and now the speech of each pupil is taken down regularly on gramophone records. According to Director BERING LIISBERG's statement the results are a great deal better than those obtained previously by ULRICH; but a proper, objective estimate of the results will not be possible till a greater number of speech records have been taken down in the *State Institute for Defects of Speech*.

Summary.

In Denmark the surgical treatment of harelip and cleft palate has been centralized to Diakonissestiftelsen's Hospital, Copenhagen, through the State Institute for Defects of Speech.

The natal frequency has been found to be 1.50 per mille (193 to 128,306). 9 per cent were still-born. 12 per cent died within 10 days of birth. The number of patients suffering from harelip and/or cleft palate is judged to be about 4,000 in Denmark, distributed as follows: 25 per cent with harelip, 50 per cent harelip associated with cleft palate, and 25 per cent isolated cleft palate.

The chief causal factor is that of inheritance. We have to do here with two genetically different deformities, *i. e.* 1) harelip with or without associated cleft palate, occurring most often in men, with a manner of inheritance that is generally of a recessive character ("conditioned dominance"), and 2) isolated cleft palate, occurring most often in women, and presenting a dominant manner of inheritance. Empirical figures for genetic prognosis show that eugenic measures are generally unnecessary.

A total of 1,000 patients were operated on in Diakonissestiftelsen's Hospital by surgeon-in-chief V. FOGH-ANDERSEN from Oct. 1, 1934, when Dr. ULRICH died, until Febr. 1, 1945. Infants are operated on in a light chloroform anesthesia, and adults in local anesthesia. The harelips are treated according to VEAU's method when the infants are 2 months old. In the cases of associated cleft palate, the hard palate is closed at the same time. In bilateral cases, each side is treated separately with an interval of 6 to 8 weeks. As regards the corrective plastics, the technique varies according to the nature of the case submitted to treatment. The cleft palates are treated at the age of 2 years by a method which is in the main a combination of those introduced by VEAU and ERNST.

31 of the 726 patients operated on for harelip, and 3 of the 537 operated on for cleft palate died after the operation. 13 of the deaths were presumably due to intercurrent diseases (occurred 3 weeks or more after the operation). 11 of the remaining deaths were due to typical postoperative hyperpyrexias.

The results of the harelip operations were in the main satisfactory, both as regards the primary operations and the corrective plastics. As to the cleft palate operations we cannot yet

make an estimate of the results. The anatomical result was generally good, but we cannot judge of the functional result, before the children operated on according to the modern technique have attained the age at which they are summoned for speech lessons to the State Institute for Defects of Speech.

Zusammenfassung.

In Dänemark ist die chirurgische Behandlung der Hasenscharte und der Gaumenspalte durch das Staatliche Institut für Sprachleiden in das Diakonissenkrankenhaus in Kopenhagen zentralisiert.

Als Häufigkeitszahl bei der Geburt wurde für Dänemark 1.50 ‰ gefunden (193: 128,306). 9 ‰ waren totgeboren, 12 ‰ starben innerhalb von 10 Tagen nach der Geburt. Die Anzahl Patienten in Dänemark mit Hasenscharte oder Gaumenspalte wird auf etwa 4,000 geschätzt, davon 25 ‰ mit Hasenscharte, 50 ‰ mit Hasenscharte + Gaumenspalte und 25 ‰ mit isolierter Gaumenspalte.

Der wesentliche ursächliche Faktor ist Erbllichkeit. Es handelt sich um zwei genetisch verschiedene Missbildungen, nämlich 1) Hasenscharte mit oder ohne begleitende Gaumenspalte, am häufigsten bei Männern, Erbgang in der Regel rezessiver Art (»conditioned dominance«), und 2) isolierte Gaumenspalte, am häufigsten bei Frauen, Erbgang dominant. Empirische Erbprognoseziffern zeigen, dass eugenische Massnahmen sich im allgemeinen erübrigen.

Seit dem Tode Dr. ULRICH's am 1.10.34 sind im Diakonissenkrankenhaus im ganzen 1,000 Patienten (bis zum 1.2.45) von Oberchirurg Dr. V. FOGH-ANDERSEN wegen Hasenscharte oder Gaumenspalte operiert worden. Kinder werden in leichter Chloroformnarkose operiert, Erwachsene in örtlicher Betäubung. Die Hasenscharten werden im Alter von 2 Monaten nach der VEAUSCHEN Methode operiert. Bei begleitender Gaumenspalte wird in der gleichen Sitzung der harte Gaumen geschlossen. Bei doppelseitigen Fällen werden die beiden Seiten, jede für sich, mit einer Zwischenzeit von 6—8 Wochen operiert. Bei den Korrektivplastiken wird je nach Art des Falles mit wechselnder Technik operiert. Die Gaumenspalten werden im Alter von 2 Jahren operiert, nach einer Methode, die eine Art Kombination der von VEAU und ERNST angegebenen Verfahren darstellt.

Von 726 wegen Hasenscharte operierten Patienten starben 31. Von 537 wegen Gaumenspalte operierten starben 3. Von den Todesfällen beruhten 13 wahrscheinlich auf interkurrenten Erkrankungen (3 Wochen oder mehr nach der Operation gestorben). Von den restierenden Todesfällen waren 11 typische postoperative Hyperpyrexien.

Die Ergebnisse der Hasenschartenoperationen waren im grossen ganzen! befriedigend, und zwar sowohl die der primären Operationen als auch die der korrektiven Plastiken. Die Ergebnisse der Gaumenspaltenoperationen lassen sich noch nicht beurteilen; das anatomische Resultat war zumeist gut, das funktionelle kann jedoch noch nicht beurteilt werden, ehe die mit der neuen Technik operierten Kinder das Alter erreicht haben, wo sie in das Staatliche Institut für Sprachleiden zu Sprechkursen einberufen werden.

Résumé.

Au Danemark le traitement chirurgical des becs-de-lièvre et des divisions palatines a été centralisé à l'Hôpital des Diaconesses à Copenhague par l'initiative de l'Institut d'État pour les Infirmes du Langage.

La fréquence de l'affection à la naissance s'est trouvée être de 1.50 ‰, au Danemark (193: 128,306). Dans 9 % des cas il s'agissait de morts-nés. 12 % des enfants décédèrent dans les 10 premiers jours après la naissance. On estime à environ 4,000 le nombre des sujets, au Danemark, atteints de bec-de-lièvre ou de division palatine, 25 % d'entr'eux ayant un bec-de-lièvre, 50 % un bec-de-lièvre associé à une division du palais, et 25 % une division du palais seul.

L'hérédité est le facteur étiologique essentiel. On parle de deux malformations génétiquement différentes, qui sont:

1) Le bec-de-lièvre, avec ou sans palatoschisis concomitant, dont la fréquence est la plus grande chez les hommes et l'hérédité en général de caractère récessif («conditioned dominance»), et

2) la division isolée du palais, plus fréquente chez les femmes, à hérédité dominante. Les chiffres empiriques du pronostic héréditaire montrent que, dans la règle, des mesures eugéniques préventives ne sont pas requises.

Depuis la mort du Dr ULRICH, le 1.10.34, le Dr V. FOGH-ANDERSEN, chirurgien en chef de l'Hôpital des Diaconesses, y a opéré en

tout 1,000 sujets atteints de bec-de-lièvre ou de division palatine (jusqu'au 1.2.45). Les enfants sont opérés sous narcose superficielle au chloroforme, les adultes sous anesthésie locale. On intervient sur les becs-de-lièvre à l'âge de 2 mois, en suivant la méthode de VEAU; s'il y a un palatoschisis associé, on ferme dans la même séance le palais dur; en cas de lésion bilatérale on n'opère qu'un côté à la fois, avec un intervalle de 6—8 semaines entre les deux temps. S'il s'agit de plasties correctrices, diverses techniques sont utilisées, selon la nature de chaque cas. Les divisions palatines sont entreprises à l'âge de deux ans, par une méthode qui est assez exactement une combinaison des procédés indiqués par VEAU et par ERNST. 31 des 726 malades opérés de bec-de-lièvre moururent, et 3 des 537 où l'on intervint pour division palatine. 13 des décès furent dus vraisemblablement à des maladies intercurrentes (morts 3 semaines ou davantage après l'opération). Des morts restantes 11 ont été causées par des hyperthermies postopératoires typiques.

Les résultats des opérations pour bec-de-lièvre ont été satisfaisants dans l'ensemble, aussi bien après les opérations primitives qu'après les plasties correctrices. Ceux des interventions pour division palatine ne peuvent encore être appréciés; du point de vue anatomique ils étaient bons la plupart du temps, mais on ne saurait encore juger de leur qualité fonctionnelle avant que les enfants, opérés selon la nouvelle technique, aient atteint l'âge où ils seront admis aux leçons de l'Institut d'État pour les Infirmes du Langage.

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The Differential Diagnosis and Treatment of Tuberculomas in the Lung.¹

By

E. DAHL-IVERSEN and P. FLEMMING MØLLER.

DAHL-IVERSEN:

According to our experience during the last two years or so, the differential diagnosis between an isolated tuberculous process in the lung, with or without roentgenologically demonstrable desintegration, and a tumor, an infected cyst or a chronic abscess, can be very difficult or even impossible without an exploratory thoracotomy. The form of carcinoma of which there will particularly be question in this connexion is the oftenest occurring massive, nodular type, sometimes with demonstrable central disintegration. As regards the question tuberculosis or tumor there are two possibilities: that of mistaking a tuberculosis for a tumor, or the reverse. We shall illustrate the former — the differential diagnosis between a nodular tuberculosis and a neoplasm — by a couple of examples, and show a picture of tuberculosis which simulates that of a chronic abscess in the lung.

Tuberculoma is the clinical designation for what is pathoanatomically termed a *conglomerate tubercle*. These conglomerate tubercles occur especially in the basal portions of the cerebrum, in the cerebellum and the pons, and in the spleen. They are oftenest round, spherical or buckled, and may occur singly or multiple. Their size is from that of a pea to that of an apple. When they have existed for some time, the main portion becomes caseous, and on the section surface there appear irregular stripes, more or less

¹ Read at the meeting of the Danish Tuberculosis Society Oct. 10th, 1945.

concentrically arranged. The marginal zone is reddish-grey or grey, soft and comparatively narrow. As result of disintegration and deliquescence, abscesses form, with cheesy or yellowish-green pus and a broader or narrower marginal zone. Tuberculomas occur mostly in young individuals.

This patho-anatomic picture, which is well known from the central nervous system, we have met with in the lung, where it, according to the available literature, is little known clinically and, as far as we can see, is not described even in the newest handbooks of pathologic anatomy; probably because the pathologists do not meet with it at the dissecting-table. I shall describe our experiences, and in that connexion make some remarks about the best therapy to be employed.

Our first case of tuberculoma in the lung was operated on by HUSFELDT in 1943, the two following by me, in 1945.

The *patient in the first* of these three cases was a married woman, 33 years old. Three months before her admission she got periodical pains in the right side of the chest, especially after any exertion. Deep respiration caused increase of the pain, which was of a stitch-like character. The symptom set in suddenly. There was no expectorate, fatigue or loss of weight. She did not think that she had been febrile, but there had been night-sweats. There was nothing else of interest in the anamnesis, particularly no tuberculosis in the family or among her associates. Her evening temperature in the first ten days of her hospitalisation was, in the average, 36.8° C., varying between 36.9° and 37.9° . The morning temperature varied between 36.3° and 37.1° . The respiration was between 16 and 20, a few times higher, about 30. Stethoscopy of the lung revealed nothing abnormal. Sedimentation rate, 30; Sicca, 91; Wassermann, negative; Mantoux, in strength 1:1000, positive. Cultivation of stomach-slucings gave 2 colonies of human type. Blood pressure, normal. *Roentgenography of the lungs* showed a clean picture, except as regards the right lower lobe, where there just above the center was an infiltration as large as a lady-apple, with a walnut-sized rarefaction in the middle (Fig. 3 and 4). Its form was slightly irregular, but its demarcation sharp; there was no fluid level in the rarefaction. A few strong, linear striae radiated from the right hilus down towards the infiltration. A following *bronchoscopy* showed normal conditions, especially in the right side. At that time we did not yet have the result of the cultivation from the stomach lavage, which could not be expected until five weeks later. The diagnosis was uncertain, because it from the picture before us might just as well be a disintegrating lung tumor as an isolated tuberculosis, a tuberculoma or perhaps even a chronic abscess. In order to get at the matter more closely, and *exploratory thoracotomy* was done under N_2O-O_2 -ether anesthesia with respirator, through a posterolateral incision with re-

section of the 7th rib. In the right lower lobe there was found a yellowish-white, translucent tumor, the size of an orange. At palpation, the hilus glands did not feel enlarged. *Lobectomy* was done, with isolated treatment of the pedicle. The wound was closed without drainage, followed by aspiration of 600 cc. of air. Alfasol in the pleura and blood transfusion were given during the operation. Following the latter, the patient's temperature rose to 39.2°C . From the 9th day following, it was below 38° . The postoperative course was smooth, and the patient was discharged, healed, 25 days after the operation.

The prepared specimen from the operation showed, when cut open, a cavity in the lobe, filled with a mushy content and surrounded by a thick wall of several concentric layers. *Microscopy* showed centrally a caseous tissue, in the marginal zone necrotic and necrobiotic tissue, and, more peripherally, tuberculous granulation tissue with a copious immixture of connective tissue. The surrounding lung tissue was compressed and atelectatic. In the tuberculous tissue there were numerous acidfast rods.

At a follow-up examination in October, 1945, the patient was found well (Fig. 5). Fifteen months ago she gave birth to a child.

The next two patients are a man, aged 43, and a woman, aged 19 years.

The man began to feel tired and seedy two months before his admission, had no appetite and lost 4—5 kg. in weight in that time. His temperature became subfebrile, there came a slight, dry cough, but there was no expectorate. He also got slight, fleeting pains here and there in the limbs. There was no dyspnea, and no pain in the chest. Before, his health had always been perfectly good. A sister had died of tuberculous meningitis in 1934; otherwise there had been no case of tuberculosis in his family or among his associates. The family had been examined at the ambulant tuberculosis station, and the patient himself by his physician, who also had him roentgenographed and his sputum examined; there were no tubercle bacilli in the latter. In a posterior-anterior roentgenograph, an infiltrate was found in the front of the right hilus. The patient was admitted to the State Hospital, service B, where he was treated with rest in bed and diathermy of the thorax for two weeks, whereupon he was transferred to us. During his stay in the medical service his temperature was normal, and he put on 5 kg. in weight, but was still slender and thin. There was some slight expectorate, which at repeated examinations was found without tubercle bacilli or tumor cells. Mantoux in strength 1:10,000 was positive in 48 hours. Stethoscopy of the lung revealed nothing abnormal. Respiration rate, 18. Blood picture, normal. Sicca, 97; sedimentation rate, 38 mm/h; Wassermann, negative; blood pressure and urine, normal.

The roentgen examination of the patient shortly after admission showed (Fig. 1) just in front of the right hilar region an evenly rounded intumescence, situated posterior to the middle part of the sternal body and extending a little way up behind the lower part of the manubrium;

its size being somewhere between that of a duck's and a goose's egg. In its upper third was a smooth, air-filled cavity, delimited downwards by a horizontal fluid level. The lower part of the intumescence was homogeneous and gave a rather intense shadow. About the air-filled space there was only seen a thin mantle of densified tissue. The trachea and bifurcation looked natural. The other parts of the right lung and the entire left lung presented nothing abnormal. A single gland in the right hilus was probably enlarged. *Tomography* gave no additional information. *Bronchoscopy* was not done, because it, in view of the situation of the intumescence, could not be expected to tell us anything, either; and *bronchography* was contraindicated because the immediate interpretation of the picture before us was that of a pulmonary abscess of chronic type or of an infected pulmonary cyst, which in lateral projection seemed to adhere to the anterior wall of the thorax, close to the body of the sternum (Fig. 2). If it arose from the lung, the process would be situated in the anterior border of the upper lobe, unless it were a case of mediastinal cyst with infection; though the latter diagnosis was less likely than any of the two first named. A circumstance that might speak against the diagnosis of chronic abscess, infected pulmonary or mediastinal cyst was the fact that there had been no acute infection or catarrhal condition in the air passages preceding the onset of the symptoms. We also considered the possibility of tuberculosis, but found this unlikely on the existing basis.

Anterior *thoracotomy* was done, under N_2O-O_2 -ether anesthesia with respirator, with resection of the 4th rib for a distance of 15 cm. from the sternum. The process was reached at once; it was not adhering to the thoracic wall. It was situated anteriorly in the border of the upper lobe and adhered to the superior vena cava, from which it had to be detached partly with the finger, partly with blunt scissors. It was completely delimited from the surrounding lung tissue, which felt and looked normal. Above the process there were a number of larger and smaller pulmonary cysts, or rather a localised bullous emphysema. The individual cysts were separated from one another. Swollen glands could be felt in the hilus. The process resembled an infected pulmonary cyst situated in the outermost margin of the lung, where it, after being detached, hung connected with the latter by a broad pedicle. It was removed by *resection* through normal lung tissue, and the resection surface invaginated under a row of Lembert's pleural sutures. Also the cystic portion of the lung, situated above, was resected. After the hemostasis had been overseen, 4 grams of alfasol were poured in over the field of operation. The lung was insufflated, the wall of the thorax closed, and a drain inserted in the side, in the 5th intracostal space, being carried down under closed drainage.

The removed preparation showed a greyish-yellow border of tissue, surrounding a cavity containing cheesy masses and a puriform fluid resembling tuberculous pus. Below the cavity there was a broad mass resembling tuberculous granulation tissue. *Microscopy* showed the surface of the process toward the lung limited by a fibrous portion. Inwards from this there was a border partly of necrotic tissue, partly

of tuberculous granulation tissue interspersed with broad fibrous striae. In the tissue, there were acidfast rods. The other resection preparation showed a bullous emphysema. We thus have in this case the same anatomic picture as in the first, except that there the process of disintegration was more advanced than in the other.

The postoperative temperature reaction was very marked, with steady rises to maximum 40.3° C. during the first two weeks after the operation, after which time there was a critical drop to normal. Sulfathiazol was given, 34 grams in all. A roentgen examination 3 days after the operation showed infiltrative densifications corresponding to the site of the wounds in the lung. These were roentgenologically interpreted as pneumonic infiltrates. Seven days after the operation, the wound opened anteriorly, medially at the sternum, and a thin, serous, clear fluid was evacuated from a circumscribed cavity at the level of the field of operation. There was no life in the edge of the wound, but no necrosis was seen either in the wound in the thorax or in the lung underneath. Three weeks after the operation there came a profuse bleeding from the lung, out through the wound. The hemorrhage was stopped by tamponage with stryphnon gauze, and blood transfusion was given. As there, about 7 weeks after the operation, still was a flat cavity, about the size of a palm, at the level of the 2nd to 4th rib, a small *Estlander's thoracoplasty* of these and their cartilages was done over an extent of about 8 cm. It was found, however, that the cavity extended up under the 1st rib, and this part of it was therefore filled by muscle-plastics from the pectoralis major. The walls of the rest of the cavity could be brought into contact with each other without tightening after the ribs and cartilages had been removed as described. At the level of the former resection surface of the lung, granulation tissue of tuberculous character was seen, while the rest of the granulations in the walls of the cavity looked fresh. The wound healed without reactions in the course of 12 days, but afterwards a small fistula formed in the middle of the cicatrix. The secretion was slight. The patient was discharged a month after the last operation, well, with normal temperature and without cough or expectorate. He is being kept under control and is recommended for sanatorium cure. According to written information a few days ago, the fistula has not closed yet. A follow-up in January, 1946, has shown that the fistula has closed, and that the patient is well and has put on considerable weight.

The case history of *the woman* 19 years old is as follows. Three—four days before her admission to medical service B on May 22th, 1945, she got stitchy pains in the right side of the chest, downwards, posteriorly, when she breathed deeply. At the same time, she felt feverish; her temperature at admission was 38.3° C. There was no cough or dyspnea. After a few days she was transferred to our service. Her temperature after admission here was in the evening between 37.3° and 37.6° , in the morning between 36.9° and 37.1° C. The respiration between 16 and 24, the pulse between 70 and 80. The state of nutrition below medium. Stethoscopy of lungs and heart showed nothing

abnormal. Also the rest of the examination showed normal conditions. Blood pressure, 110/60; Wassermann, negative; blood sedimentation rate 3 mm/h; Sicca, 110; Mantoux in strength 1:10,000, positive. The patient had before been well until 1940, when she got right-side pleurisy. She lay in bed at home for 7—8 weeks, and has since been controlled at the Copenhagen tuberculosis station every six months. There had never been any expectorate. The stomach sluicings were examined at the tuberculosis station, but no tubercle bacilli found. In the last six months, she had lost 5—6 pounds in weight, but her appetite was still good. There was no night-sweat, and there had not been any cough or expectoration. She had no tendency to catch cold.

Roentgen examination of the lungs showed downwards on the right side a tangerine-sized, sharply circumscribed soft-tissue shadow (Fig. 6), which in lateral projection was seen to lie in the posterior part of the thorax, with a broad base on the wall of the latter. In oblique projection, the process seemed to have a close relation to the 10th rib. There were fine, denser striae in it, resembling calcifications (Fig. 7). Besides this larger tumor, there was a smaller one of the same appearance and character more anteriorly in the lung. Otherwise nothing abnormal could be demonstrated in the latter, and there was no exudate in the pleura.

The picture presented suggests a pleura tumor, metastases to the lung from a sarcoma or a carcinoma, costal tuberculosis or — in the light of our present experience — multiple tuberculomas in the lung. Against pleura tumor and costal tuberculosis speaks the presence of the smaller process, which lies free in the lung; against metastasis, as regards carcinoma, the patient's age, besides the fact that there was no primary tumor anywhere. The picture and the anamnesis may speak for the last possibility named, that of multiple tuberculomas in the lower right lobe. The operation being performed we obtained the loan of a series of roentgenograms taken at the tuberculosis station from May, 1940, to October, 1944. In these was seen first a right-side pleurisy, which cleared up by the end of July, 1940. At that time there was no infiltration in the right lower lobe, but a year later a nodule was seen, lying free in the lung, corresponding to the large one now found. By August, 1944, it had grown to its present size, and by that time the smaller one, number two, had manifested itself. Both were at that time circumscribed by a very faintly densified zone, probably a calcification. The diagnosis of multiple tuberculomas therefore became the most likely. The indication for our operative intervention was partly diagnostic, partly therapeutic. In case of tuberculomas it was my intention to do a lobectomy. On June 6th, 1945, *thoracotomy*, with resection of the 9th rib, was done under N_2O-O_2 -ether anesthesia with respirator. At the level of the lower lobe, the lung adhered to the thoracic wall everywhere. It was loosened from it without the free pleura being reached. Downwards, posteriorly in the lower lobe were felt two separate encapsulated processes, the larger of which was situated, with a broad base, in the border of the lung, the other a little deeper and more anteriorly. As they could be removed very easily through sound lung

tissue, and as the resection surface, owing to the strong adhesions present, in contrast to what was the case in the previous patient would be lying outside the pleura, *resection of the lung* was decided upon, instead of the planned lobectomy. The thoracic wall was closed and a drain inserted into the cavity, air-tight, through the 9th intercostal space, being carried down under closed drainage.

For five days after the operation, the patient's temperature rose to 39.3° C., and sulfathiazol was given. As the secretion had ceased on the third day, the drain was removed. The following course was smooth, on the twelfth day both the wound from the operation and the drainage site were healed. The patient was discharged, well and with normal temperature, twenty days after the operation. A roentgenograph showed that the processes had been removed. She still goes to control at the tuberculosis station. According to the last information, she has now become pregnant and is in hospital with a view to possible abortus provocatus. A roentgenograph of the lung taken for control in October, 1945 (Fig. 8), shows a normal lung picture in both sides; in the side operated upon, the diaphragm stands high.

The preparation from the operation showed in the removed lung tissue two separate tuberculomas, one as large as a hen's egg, the other the size of a green walnut. In both, the central portion was filled partly with cheesy masses, partly with tuberculous pus. The marginal zone consisted of red-greyish, tuberculous-looking granulation tissue. *Microscopy* of this marginal zone showed inwards toward the cavity a thick layer of stratified, haylinised connective tissue, and outside this a structureless necrotic tissue immixed with granulation tissue containing giant- and epithelioid cells. The adjacent lung tissue was strongly hyperemic and in places atelectatic. Histologically, the most likely diagnosis must seem to be that of tuberculous abscess membrane with necrosis. Tubercle bacilli could not be demonstrated. The case is on line with the two foregoing: a process with the patho-anatomic structure of a tuberculoma in a state of disintegration, but not as far advanced as in case no. two.

As regards the *treatment of tuberculomas in the lung*, we believe that removal of the focus must be advised, and that the operation, if the pleural cavity is free, should be a lobectomy, because resection of the lung involves the risk of tuberculous infection of the pleura from the resection surface, as exemplified by our case no two. On the other hand, our third case seems to show that in cases where the field of operation is shut off from the free pleural cavity by adhesions the lesser operation of resection of the lung may suffice, provided that it can be done in sound lung tissue. Our reason for believing that a tuberculoma in the lung should be removed is not based on experiences with regard to the course of the affection when there has been no operative intervention, because there are few experiences, if any, in that respect; but is

based on experiences with tuberculomas in other sites, where it is known that they continue to grow and must be removed operatively wherever possible. Our third case, that of the young girl nineteen years old, which has been followed up for about five years, points in the same direction; during that time her tuberculomas have shown steady progression.

In the last ten years or so, the surgeons have begun to use an active, operative therapy against pulmonary tuberculosis by operation on the lung, in the form of either lobectomy or pneumonectomy, or, if so indicated, bilateral upper lobectomy. As introduction to this subject I shall briefly relate a case in which the diagnosis between tuberculosis and lung tumor could only be settled by an explorative surgical intervention, and in which the question was whether a unilateral, presumably cavernous phthisis should be dealt with by pneumonectomy or conservatively.

The patient in this *fourth case* was a man, 59 years old, like the others transferred to us from medical service B for tumor of the right lung. He had been admitted there on May 4th, 1945, after he the day before had become ill with headache, pain in the throat, cough and temperature rising to 40.5° C. After a few days, he brought up mucopurulent expectorate. Stethoscopically there was short sound over the right upper lobe, and bronchial respiration with dry and moist râles, especially after coughing. In the course of a couple of weeks the temperature became normal, but the cough and mucopurulent expectorate persisted, and the stethoscopic findings remained the same. From the anamnesis it appears that the patient in 1921 had been two months in the Øresunds Hospital with pulmonary tuberculosis, according to statement of both lungs, and in the following three months in sanatorium. In the following year he was again four months in sanatorium after a hemoptysis. Afterwards he had been well until 1937, when he was in the Øresunds Hospital a month, according to his statement for bronchitis. At that time there does not appear to have been positive tubercle bacilli in his sputum. Since 1937 he has gone to control at the tuberculosis station, and had felt well until the present symptoms set in on May 3rd, 1945.

Roentgen examination of the lungs at admission showed diffuse densification of the entire right upper lobe, with clearer and denser areas. Downwards, the process was sharply delimited corresponding to the limit of the lobe, which was drawn upwards. The right half of the thorax was markedly flattened, with the trachea rather considerably drawn over towards the right. Also the heart and the vascular trunks were somewhat displaced. In the middle and lower right lobes there was nothing positively abnormal. In the left lung there were some slightly pronounced opacities in the apex and immediately below the clavicle, but no signs of fresh processes. In lateral projection, there

was in the lower part of the right upper lobe seen a separate nodular, well circumscribed opacity, which suggested the presence of a tumor; a suggestion which was supported by the indubitable atelectasis on the right side (Figs. 9 and 10). We thereupon made repeated examinations of the expectorate for tubercle bacilli and tumor cells, but with negative result in both respects. *Bronchoscopy* showed the carina sharp and freely movable, the left bronchial tree normal. The right bronchial tree was a little redder than the left, and its mucosa slightly edematous opposite the starting point of the branch to the upper lobe. There was some secretion from it, but no tumor could be seen in the lumen, not even by the use of retrograde optics. There were no signs of tuberculous processes in the mucosa. *Bronchography* showed, as regards the right side, that only the posterior branch to the upper lobe filled, while the anterior and superior branch were suddenly interrupted by a distinct stop in the filling. *Tomography* of the upper lobe showed in the middle of the latter a rather clearly circumscribed, nodular infiltration, in which were seen several more than cherry-sized caverns; and above this infiltrate some more marbled opacities with small bronchiectasies. One would be most inclined to interpret the whole roentgenologic picture as that of a lung tumor in a state of disintegration. Besides this supposed tumor, there were sequelae of a past tuberculosis in both lungs, especially in the right. Finally, we were given the opportunity of examining the roentgenographs taken at the tuberculosis station as far back as to 1938, which showed that already at that time there was marked atelectasis in the right upper lobe. There had not been any considerable changes in the following years, but it seemed as if the densification in the last pictures had become more concentrated into a nodular form, and it was seen that there had been disintegration already at an early stage.

The *diagnosis* remained after these examinations doubtful, not as regards the presence of tuberculosis, but as regards the possibility of a carcinoma developed in the tuberculous lung. If there was no tumor, the process must be interpreted as a cavernous phthisis. It was therefore necessary to do an exploratory operation, and on June 11th, 1945 I did a *thoracotomy* with resection of the 5th rib, under N_2O-O_2 -ether anesthesia with respirator. The lung was adherent over the entire extent of the upper lobe, and the adhesions carried large vessels, which had to be ligated. The process was felt as a tumor in the lower half of the upper lobe, but details could not be felt until the latter had been detached; nor could the operability be judged of before access had been obtained to the depth. When the whole lung had been laid free without injury to the lung tissue, it was found that there was no tumor, but in the basal part of the upper lobe a cavern larger than a green walnut. By the collapse and palpation of the lung, a considerable quantity of pus became evacuated into the trachea and was immediately aspirated. There were no palpable glands in the hilus.

It now became the question whether we, in view of the fact that the diagnosis of cavernous phthisis was the most likely one, should rest content with the total collapse of the lung obtained — the apex

lying at the level of the hilus — or should excise the upper lobe, the middle and lower having been found free from tuberculosis. It turned out, however, that owing to adhesions that could not be severed it was impossible to detach the upper lobe from the rest of the lung; therefore there could only be question of a pneumonectomy. In view of the patient's age and the peaceful pathologic picture I found it best not to undertake an operation of that magnitude, but to treat his freed and collapsed lung with continued pneumothorax in connexion with a sanatorium cure. The thorax was closed primarily. The postoperative temperature was between 38° and 39° C., and became normal after 17 days. In the days following the operation the pleural exudate was removed as it formed, and replaced by air. The postoperative pneumothorax treatment was conducted by GRAVESEN. A month after the operation the patient was discharged to sanatorium cure. His temperature was normal, there was only slight cough and expectoration. Roentgen examination at the time of discharge showed that a good pneumothorax had formed in the right side, with good contraction of the lung.

During his stay in the sanatorium, the patient has put on 5 kg. in weight. He coughs considerably less, and now spits up only a few clots. He is less dyspneic, and his temperature and pulse remain normal. As repeated examinations of his expectorate have been negative as regards tubercle bacilli, he has again been examined bronchoscopically with a view to the possibility of a benignant tumor in the upper-lobe bronchus with resulting conditions, instead of cavernous phthisis. This renewed *bronchoscopy* showed that the right bronchial tree now is narrower than the left, but as regards the middle- and lower-lobe bronchus otherwise normal. The bronchus of the right upper lobe, on the other hand, has now been transformed into a narrow slit, through which a little thick pus bubbles forth and back. The mucosa is also a little red there, but no longer edematous. No tumor masses are seen, and the case must therefore still be considered as one of cicatricial stenosis of the bronchus of the upper lobe, with cavern in the lung, probably a process on tuberculous basis which has run its course. For the present we shall maintain the patient's pneumothorax.

At the time when the war cut us off from contact with the Anglo-saxon world, very little had been written about lobectomy and pneumonectomy as treatment in pulmonary tuberculosis; but the experiences already then made justified such operations, which may well be paralleled to nefrectomy in the mostly unilateral tuberculosis of the kidney. As regards the risk of occurrence or recrudescence of a tuberculosis in the contralateral organ, there is a difference, however, between the two localisations; in the lung, this complication, to judge from the available literature, is by no means a matter to be taken lightly.

FLEMMING MÖLLER:

When the roentgenologist is confronted with an isolated nodular opacity in a lung such as those in three of the cases spoken of here, his first thought will probably be that it may be a tumor. The large material of lung tumors which we have had occasion to examine since a pulmosurgical service was established at the State Hospital has given us some experience in appraising the roentgenologic picture of the lung in this affection, but has also shown us that the differential diagnosis from other pathologic conditions in that organ may be difficult, as the roentgenologic image of bronchial tumors may be very polymorphous, and therefore liable to be confounded with that of almost any affection in the lung. And the differential diagnosis from tuberculosis in its various forms is one of the things which one often has to consider when it is a question of coming to a conclusion with regard to the case presented. Also the technic employed in the examination plays an important rôle, but even the combined results of the different investigations do not always enable one to reach an absolutely positive conclusion. One must often compare the roentgenologic findings closely with the history of the case, the anamnesis and the clinical observations, and from all these conclude to the most likely interpretation. It is not always possible to establish the diagnosis with certainty roentgenologically, and specially is the estimation difficult when the pathologic process is located isolated in the pulmonary tissue, without any visible connexion with the hilus and without there being any other changes in the lung. If, moreover, there is disintegration in the infiltrate, the difficulty becomes still greater.

A case of precisely that character was the second one of those described by DAHL-IVERSEN (3098/45). In the roentgenograph there was a large, sharply circumscribed, oval opacity in the right lung, with a fluid level with an air bubble above it (Fig. 1). In the anterior-posterior view, this opacity lay about in the midline, a little toward the right, covering the right hilus and part of the medial shadow. In lateral view it was seen to lie quite anteriorly, close to the anterior wall of the thorax, and was also there quite sharply defined against its surroundings (Fig. 2). Also in projection in other planes this isolating circumscription was very apparent. Except this, there was no demonstrable abnormality in the lungs, especially no sure calcifications or lymph node tu-

mors in the hilus. The bifurcation was natural, the breadth of the carina not increased.

The picture resembled most of all that of a congenital cyst, but as no similar findings could be demonstrated in a series of roentgenographs taken of the patient at an earlier period, that diagnosis could at once be abandoned. Then the possibility of a tumor in the process of disintegration was considered. It could not be excluded, but was found little likely; especially the perfectly smooth limitation in all directions, together with the natural form of the carina and the absolutely very little "cyst-like" character of the opacity spoke against it. The most probable seemed to be a chronic lung abscess. The history of the patient's illness would fit very well with this. There had been a little fever, and pulmonary abscesses not infrequently have an insidious course. There need not be any acute manifestations, and it is not uncommon in cases with a history similar to this as surprising finding at a roentgen examination to ascertain the presence of an abscess in the lung. Tuberculosis was not thought of; nor was there anything in the history of the case that might suggest it. But of course there is such a thing as isolated tuberculous abscesses, and it was undoubtedly a fault that that possibility was not considered also, though nothing in the anamnesis pointed in that direction.

There was all the more reason why we should have done so since the first case mentioned by DAHL-IVERSEN — the one operated on by HUSFELDT (5038/43) — reminded very much of this roentgenologically and the diagnosis of tuberculosis had been established operatively. Roentgenologically (Fig. 3 and 4) there was in the right lung a clearly circumscribed opacity, the size of a lady-apple, with an irregularly oval rarefaction in the middle. Nor yet in this case were there any infiltrations in the surroundings, but there was a strong, fibrous stria across the lung, probably an interlobar thickening of the pleura. There were no hilus glands or signs of pleurisy. Also this case we were most inclined to diagnose as a lung abscess, all the more confidently because at that time there had not yet been demonstrated tubercle bacilli by cultivation from the stomach sluicings, as was done later. The roentgenologic picture was not thought suggestive of tuberculosis, because it did not give evidence of any other tuberculous manifestations, nor did it really resemble a picture of that disease. Moreover, the tomographic examination

showed so clearly an isolated process that it was difficult to believe in tuberculosis.

Also in this case the possibility ought, however, to have been considered, for when an isolated cavern is found in a lung, tuberculosis cannot be excluded, of course, unless a search has been made for tubercle bacilli. But in judging about a case like the one of which we are speaking, not only abscess and tuberculosis must be considered, but also the possibility of a lung tumor in the process of disintegration must be thought of, and was in this case. Such a tumor, arising within the pulmonary tissue, may give exactly the same picture (Fig. 5; after the operation).

In the third case, when it was referred to the roentgen clinic of the State Hospital for examination, there were found two isolated, round, sharply circumscribed, homogeneous shadows downward in the right side; one of them a little posteriorly, with a broad base on the thoracic wall, the other more anteriorly, as it seemed up against the diaphragm (Figs. 6 and 7). At that time there was no other demonstrable abnormality in the lung, and no exudate in the pleura. We dared not be positive about the diagnosis, but inasmuch as the processes were broadly based on the thoracic wall and the diaphragm, we rather judged them to be small pleural tumors. Only later were we informed that at an earlier period tubercle bacilli had been found in the patient's stomach sluicings and a pleurisy demonstrated; and when we then obtained the earlier roentgenographs from the tuberculosis station and compared them with the recently taken, we could see how the nodules described gradually developed as the pleurisy regressed, until they stood as isolated opacities in the picture. If we had known of the earlier development of the changes to begin with, we would probably have been able to diagnose the case as tuberculosis, but as the matter stood there were no clues to a sure interpretation of the picture (Fig. 8; after the operation).

If we now compare these three cases, which all proved to be isolated tuberculous processes, we see that the pictures strikingly resemble each other, specially the two first ones, in which there was cavern formation in the middle of the opacities; and one might perhaps be led to believe from this that when one in the future was confronted with such pictures it would be safe to diagnose the case as tuberculosis. This is far from being the case, however. They have only taught us that also the possibility of an isolated tuberculous inflammation in the lung must be con-

sidered in judging about such changes, and has confirmed the old fact that it is not always safe to make a positive diagnosis from the roentgenologic picture alone, because other affections in the lung may give exactly the same picture; and as regards the differential diagnosis it is specially of abscesses and tumors that there may be question.

But it was a fault that tuberculosis was not thought of in the appraisalment of the three cases here discussed, especially as the picture of isolated, sharply circumscribed tuberculous infiltrations in the lung is by no means an uncommon phenomenon, though perhaps not always borne in mind, even by the tuberculosis specialists. And of course such infiltrates may grow large, and disintegration at last set in in the middle, as it was seen in our cases. In the two last of these, the diagnosis would have been clear if we had known the full history of the cases, but in the first one there was nothing in the case record that could give any clues in that direction.

In the fourth case we have an entirely different type of changes. Here, the anamnesis did not leave any doubt that there had been tuberculosis of both lungs, especially of the right, twenty-one years before. It had apparently run its course, and the patient had been well for many years, until the present symptoms set in in May, 1945. At a roentgen examination on the 17th of that month (4419/45) there was found (Fig. 9) a diffuse thickening of the entire right upper lobe, sharply delimited downwards corresponding to the margin of the lobe. The latter was drawn considerably upwards, the right thoracic wall was markedly flattened; the trachea was drawn rather far over towards the right, and the heart and vascular trunks displaced in the same direction. The thickening was not quite diffuse, there were denser and clearer areas, and at first we were most inclined to think that it was a case of an old tuberculous process with fibrous changes and atelectasis of the right upper lobe. There was nothing positively abnormal in the lower part of the right lung; still, there was a diffuse veil over the entire right half of the thorax. In the left side, there were some slightly pronounced old infiltrations in the apex and just below the clavicle.

We were not quite sure about the diagnosis, though. Especially in the lateral view (Fig. 10) there was in the lower part of the upper lobe a clearly circumscribed, nodular opacity, which did not quite resemble the sequelae of a tuberculosis; and on closer study

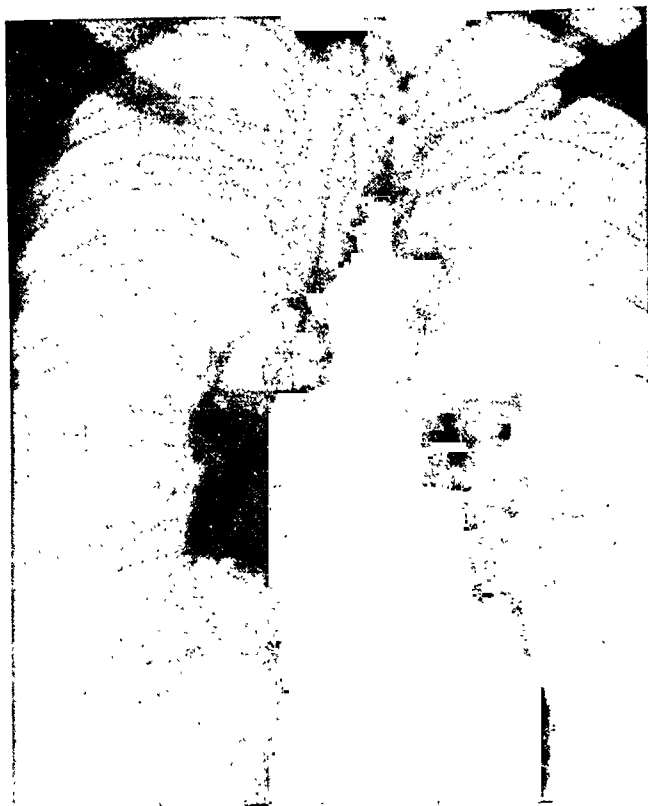


Fig. 1.

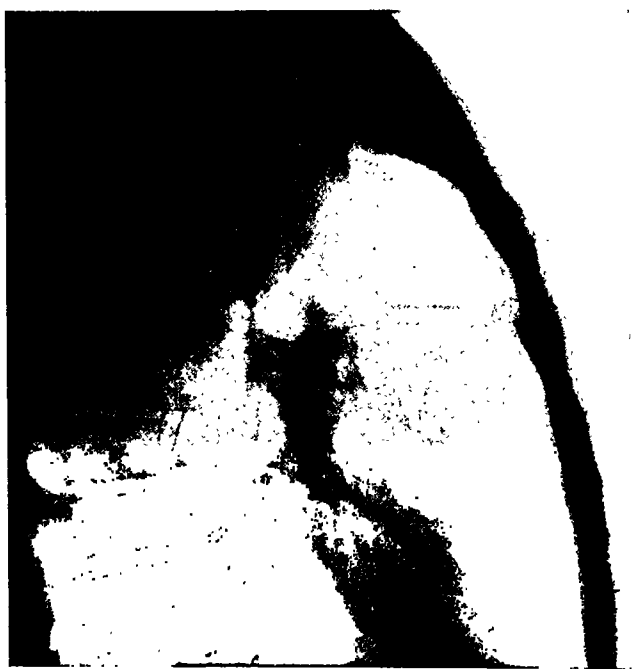


Fig. 2.



Fig. 3.



Fig. 4



Fig. 5.

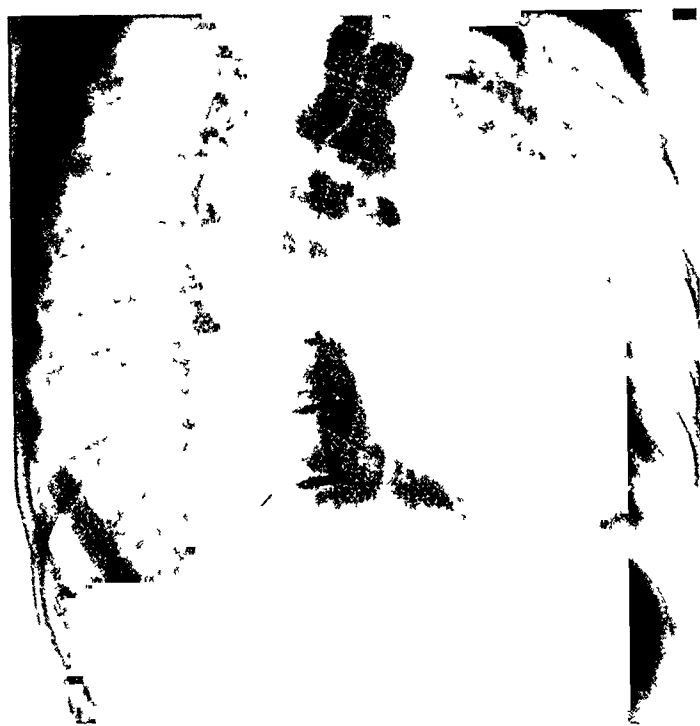


Fig. 6.



Fig. 7.

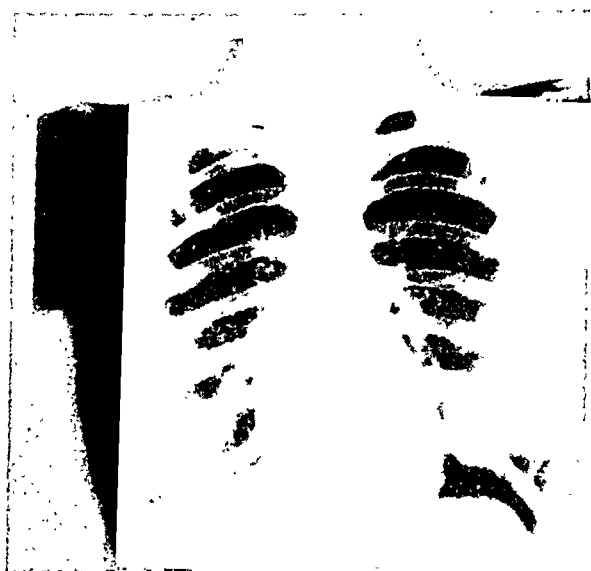


Fig. 8.



Fig. 9.



Fig. 10.

of the films we became more and more inclined to think that besides the indubitable tuberculous changes there might also be a tumor. Already earlier roentgenographs, from 1938, from the tuberculosis station, showed that there at that time was atelectasis in the right upper lobe, but it was as if the opacity in the last pictures taken had become more concentrated into a nodular form; which we thought supported the supposition of a tumor. This diagnosis was further supported by a bronchography; only the posterior branch to the upper lobe filled, while the anterior and superior branches were interrupted by a distinct stop in the filling. Tomography confirmed the nodular infiltration in the middle of the lung, but also showed the presence of several caverns, some of them as large as a cherry, in the densified area. After this, we could, roentgenologically, only hold to the supposition of a tumor, besides the old tuberculous changes. The result of the operation might perhaps speak for tuberculosis, nevertheless; still, the subsequent development of the case leaves a doubt, and perhaps the diagnosis of tumor will in the end prove the true one.

Though the picture of this case in itself has no connexion with the three first cases, it nevertheless furnishes an excellent illustration to the difficulties which one encounters, also roentgenologically, when it becomes a question of differential diagnosis between tuberculosis and a tumor, and which one not infrequently may meet with in a pulmosurgical service.

Summary.

Tuberculoma is the clinical designation for what is patho-anatomically termed a conglomerate tubercle, and occurs especially in the central nervous system and the spleen. An entirely similar process occurs in the lung under the picture of a tumor or a chronic abscess. The authors present three cases with this pathologic picture. Two of them were treated by resection of the lung, the third by lobectomy. It is stated that tuberculomas of the lung should be removed by surgical operation, because they may be expected to continue to grow, there as in other organs. One of the cases related, which has been under observation for several years, points in the same direction, inasmuch as the process during that time has continued to enlarge. The conclusion is that lobectomy should be performed if the pleural cavity is free, while the lung

may be resected in cases where the field of operation is shut off from a free pleural cavity by adhesions, provided that the resection can be done in sound tissue. The three case histories are used to show the difficulties of the differential diagnosis, which involves the question: tuberculosis-tumor, infected cyst or chronic pulmonary abscess. The diagnosis between these can be very difficult, or even impossible, without an exploratory thoracotomy. Finally, a fourth case is described, of unilateral, cavernous phthisis with roentgenologic changes suggesting carcinoma; a suggestion which only an explorative operation proved erroneous. In this case, the question stood between pneumonectomy and conservative intervention in the form of pneumolysis. In view of the nature of the case and the patient's age the conservative measure was chosen, but it is pointed out that in cases where the conditions permit it an active surgical therapy in pulmonary tuberculosis, by operation on the lung itself, either in the form of lobectomy or pneumonectomy, or, if so indicated, of upper bilateral lobectomy, has its field and will be the future treatment in such cases.

Roentgenologically, it is pointed out that the picture of bronchial tumors can be very polymorphous and may express itself in changes that may be confounded with the most different pulmonary affections. One of the things one oftenest has to consider when it comes to deciding about a case before one, is the diagnosis from tuberculosis in its various forms. It is not always possible to make a sure diagnosis roentgenologically. The anamnesis, the case history and the other clinical findings must all be taken into consideration, and the difficulties become even greater if the pathologic process is situated isolated in the pulmonary tissue, without visible relation to the hilus and without any other changes in the lung, and especially if there is disintegration in the infiltrations.

Zusammenfassung.

Tuberkulom ist die klinische Bezeichnung für den pathologisch-anatomischen Begriff Konglomerattuberkel, besonders im Zentralnervensystem und in der Milz auftretend. Ein ganz ähnlicher Prozess kommt in der Lunge unter dem Bilde eines Tumors oder eines chronischen Abszesses vor. Es werden drei Krankheits-

bilder dieser Art vorgelegt, die in zwei Fällen mit Resectio pulmonis, im dritten mit Lobektomie behandelt wurden. Es wird erwähnt, dass Tuberkulome der Lunge operativ zu entfernen sind, da zu erwarten ist, dass sie hier, wie in anderen Organen, beständig weiter wachsen. Der eine der mit geteilten Fälle, der mehrere Jahre lang beobachtet wurde, spricht auch hierfür, indem der Prozess während der Beobachtungszeit fortwährend fortschritt. Es wird der Schluss gezogen, dass der bei freier Pleurahöhle zu verwendende Eingriff die Lobektomie ist, und dass die Lungenresektion in denjenigen Fällen vorgenommen werden kann, wo das Operationsfeld durch Verwachsungen gegen die freie Pleurahöhle abgeschlossen ist, und unter der Voraussetzung, dass die Resektion in gesundem Gewebe stattfinden kann. Die drei Krankengeschichten werden zur Beleuchtung der differentialdiagnostischen Schwierigkeiten verwendet, die bei der Frage Tuberculose-Tumor, infizierte Zyste oder chronischer Lungenabszess vorliegen.

Diese Differentialdiagnostik kann ohne explorative Thorakotomie sehr schwierig oder geradezu unmöglich sein. Schliesslich wird ein 4. Fall mitgeteilt von einseitiger, kavernöser Phthise mit röntgenologischen Veränderungen, die auf Krebsbildung deuteten, was nur durch einen explorativen Eingriff widerlegt werden konnte. In diesem Falle stand man vor der Frage: Pneumonektomie oder ein konservativer Eingriff in Form einer Pneumolyse. Angesichts der Art des Falles und des Alters des Kranken wählte man in diesem Falle den konservativen Eingriff, es wird jedoch darauf aufmerksam gemacht, dass eine aktive, operative Therapie in Gestalt eines Eingriffes an der Lunge selbst, entweder als Lobektomie oder als Pneumonektomie oder evtl. als bilaterale obere Lobektomie bei Lungentuberkulose in geeigneten Fällen ein Indikationsgebiet hat und bei solchen Fällen die Behandlung der Zukunft sein wird.

Röntgenologisch wird betont, dass das Bild bei Bronchialtumoren sehr vielgestaltig sein kann und in Form von Veränderungen hervortreten kann, die mit den verschiedensten Lungenleiden verwechselt werden können. Die Differentialdiagnose gegen die verschiedenen Formen der Lungentuberkulose ist eine der häufigsten Fragen, vor die man gestellt wird, wenn man zur Beurteilung eines vorliegenden Falles Stellung nehmen muss. Eine sichere Diagnose lässt sich nicht immer röntgenologisch stellen. Die Anamnese, die Krankengeschichte und die übrigen klinischen

Befunde sind bei der Beurteilung des Falles eingehend mit zu erwägen, und falls die Veränderungen isoliert im Lungengewebe sitzen, ohne sichtbare Verbindung mit dem Hilus, ohne andere Veränderungen in der Lunge, sowie ganz besonders, wenn gleichzeitig eine Einschmelzung der Infiltrate vorliegt, werden die Schwierigkeiten noch grösser.

Résumé.

Cliniquement on appelle tuberculome ce que les anatomo-pathologistes entendent par conglomérat de tubercules, lésion qui se rencontre spécialement dans le système nerveux central et dans la rate. Un processus tout à fait semblable se rencontre dans le poumon sous le tableau d'une tumeur ou d'un abcès chronique. Trois observations de ce genre sont présentées ici: deux des cas furent traités par résection du poumon, le troisième par lobectomie. Les auteurs font remarquer que les tuberculomes pulmonaires doivent être extirpés chirurgicalement parce qu'on peut s'attendre à ce qu'ils s'accroissent de façon continue, ici comme dans d'autres organes. L'un des cas rapportés, qui fut observé pendant plusieurs années, parle dans le même sens, vu que le processus alla constamment en augmentant pendant tout le temps où il fut suivi. En conclusion, c'est la lobectomie qui représente l'intervention à laquelle il faut recourir quand la cavité pleurale est libre, la résection du poumon pouvant être utilisée dans les cas où le champ opératoire est isolé de la plèvre libre par des adhérences, sous la réserve que l'exérèse puisse avoir lieu en tissus sains. Les trois observations servent à illustrer les difficultés du diagnostic différentiel lorsqu'il est question de distinguer entre tuberculose-tumeur, kyste infecté ou abcès pulmonaire chronique.

Ce diagnostic différentiel peut être très ardu, ou même impossible, sans thoracotomie exploratrice. Pour finir, un quatrième cas est rapporté, concernant une phthisie caverneuse unilatérale avec des signes radiologiques qui évoquaient une néoformation carcinomateuse: seule l'intervention exploratrice put dissiper ce soupçon. Chez ce malade il fallait choisir entre la pneumonectomie et une opération conservatrice sous la forme d'une pneumolyse. Compte tenu de la nature du cas et de l'âge du patient, c'est pour l'intervention conservatrice qu'on se décida, mais les auteurs

font remarquer qu'un traitement opératoire actif, dirigé contre la tuberculose pulmonaire et s'attaquant au poumon lui-même, sous forme de lobectomie, de pneumonectomie, ou éventuellement de lobectomie haute bilatérale, trouve son champ d'applications dans les cas qui en sont justiciables et deviendra, pour ceux-ci, la thérapeutique de l'avenir.

Du point de vue radiologique ils soulignent que l'image des tumeurs bronchiques peut être très polymorphe et se traduire par des aspects susceptibles d'être confondus avec les affections pulmonaires les plus disparates. Le diagnostic différentiel avec la tuberculose sous ses différentes formes est l'un des problèmes devant lesquels on se trouve le plus fréquemment placé lorsqu'il faut arriver à une conclusion dans un cas donné. Il n'est pas toujours possible de poser un diagnostic certain par les seuls Rayons X. L'anamnèse, l'histoire de la maladie et les autres constatations cliniques doivent être prises, elles aussi, très exactement en considération pour juger du cas, et les difficultés s'accroissent encore si les lésions sont isolées au sein du tissu pulmonaire, sans attaches avec le hile et sans autres altérations pulmonaires; cela est surtout vrai lorsqu'en même temps se produit une fonte dans les infiltrations.

From "Svenska Röda Korsets Sjukhus", Surgical Department.
(Chief: Chief Surgeon ERLING F. HJORT.)

A Case of Double Bladder.

By

ERLING F. HJORT.

In this article it will be reported a case of double bladder and simultaneous deficient development of one kidney and its ureter. The patient was operated, and the one, in this case rudimentary bladder, was removed with the likewise rudimentary renal structure.

Because of the extreme rarity of the case it deserves to be reported in detail.

The patient was a male, 33 years old, K. G., who was admitted to "Svenska Röda Korsets Sjukhus" surgical department, from 17/11—12/11 1945.

Anamnesis: Healthy family. Ever since the age of 17 years the patient had periodically been nervous and depressed. His worst period had been during last summer, when he had suffered from severe depression. Later his mental condition had improved.

2 years previous to the admission he had felt pain deep in the right part of nates. The pain was like a toothache and gradually increased. It was also felt in the rectum, especially during evacuations, and later he additionally got pain during micturition. He went to a physician who ordered sulphathiazol tablets, whereafter all his symptoms vanished. There had been no discharge.

A year ago he had a transient "reminder" of his pain, lasting for a couple of days. Then there was another short-lasting relapse in the month of April, and finally a period of pain beginning in the month of June this year. This period still lasted on his admission to hospital. This time as earlier the pain was felt in right nates and in the rectum. Sometimes he had more frequent micturition with a smarting pain toward the end. No discharge and no fever. The stream of urine was somewhat fine but normally strong. He had to urinate once during the night. In the day-time he sometimes felt an almost imperious desire to urinate. No hematuria. Bowels moved daily, somewhat soft consistency, no blood. Pirquet ÷ shortly before admission. Venera denied.

Status presens, 17/9. 1945. The patient appeared somewhat thin and pale. Pulse 76, regular. Temp. 37.4. Tongue moist and clean. No edemae, no exanthemae. Pupils equal, reacted to light and accommodation. Fauces pale. Normal physical conditions over lungs and heart. Abdomen was soft and unsensitive. No palpable filling.

Exploration per rectum. Sphincter closed well around finger. Prostate of normal shape, size and consistency. *Upward to the right of the upper corner of the prostate there is felt a tumor, the size slightly more than length and thickness of a thumb*. It was bimanually palpable. The consistency was solid, elastic, possibly fluctuating. It was slightly movable and highly sensitive.

Genitalia externa were normal, on either side a normal testicle and epididymis.

The urine contained no albumin, pus, blood, nor sugar. Microscopically it was seen 7—8 red blood corpuscles per field.

Intravenous urography, 21/9. 1945, revealed no sign of calculi formation. After 20 cc of urodone there was good secretion of contrast on the left side. No secretion on the right side. After 15 min. the renal pelvis on left side was distended with contrast. On right side still no secretion. Even after 45 min. no secretion was observed on the right side. After the removal of compression there were no obstacles to the passage of the contrast urine from left side. Shadow of the bladder offered a perfectly normal picture. R.: Failure of secretion of contrast urine on right side. (DENSTAD).

Cystoscopy, 24/9. 1945. Instrumentation easy. Vesical capacity 300 cc. Vesical mucous membrane offered a perfectly normal picture. Left ureteral opening slit-shaped, normal. On the right lower half of the bladder it was noticed a smooth, semi-round bulge where the right ureter fold might be looked for. It was about the size of a walnut, not translucent, and showed no variation in the size. Without any sharp border it passed into the vesical cervix, and was completely covered with normal mucous membrane. On its medial surface it was noticed a fold, that possibly might be taken to be a ureteral opening, but it was incapable of catheterization.

On chromo-cystoscopy after intravenous injection a strong blue jet appeared from the left ureteral outlet after 5 min. On the right side no colored jet was seen.

After the cystoscopy the bladder was emptied and the tumor again palpated, rectally and bimanually. The consistency was solid, and a certain movability from side to side was clearly noticed. An upper border was also believed to be felt.

At this point the case was suspected to be a dystopic pelvic kidney, and in an effort to exclude the possibility of the presence of a normally situated right kidney a *roentgen examination* was made on 27/9. 1945, after peri-renal insufflation of air. With a pneumothorax apparatus 250 cc of air was insufflated bilaterally into the renal spaces. On the left side the kidney appeared clearly. On the right side no renal shadow was demonstrable. The air merely spread upwards along the lateral psoas contours, and below the medial part of the diaphragm.

R. suggested absence of kidney on right side (eventual pelvic kidney) (Dr. DENSTAD).

The case was now believed to be a pelvic kidney on right side, and on this assumption it was made an

Exstirpatio on 29/9 1945, under spinal anesthesia, 15 cc of percain + 340 gm of ether on gasmask. Incision obliquely on right side continued right through m. rectus with intended ligation and resection of vasa epigastr. dextr. In this way quite a good view is obtained. Peritoneum is pushed bluntly medially, and retroperitoneally one advances toward the right side of the vesical wall. The tumor is then felt as a round, about egg-sized cystic formation, situated close to the vesical wall to the right, and posterior to the vesical cervix. The tumor has a process, as thick as a little finger, pointing cranially and somewhat medially. The process is cylindrical, and like the main tumor it is cystical and distended. It closely resembles a distended ureter. The tumor is loosened, partly bluntly, partly with sharp instrument. Directly behind the symphysis, slightly to the right of the mid-line the tumor is attached to brim of the pelvis anteriorly, and had to be cut loose at this point. Before reaching that far the tumor ruptured and a watery fluid was emptied into the wound. No vascular string entering the tumor was observed. Tumor had no connection with the bladder. Up to this time the main tumor had been supposed to be a dystopic kidney, and the process a ureter that would bend backward and enter the bladder. This proved not to be the case. The process, that also emptied its content on rupture of the main tumor, appeared to run in a cranial and medial direction, crossing the vasa iliaca anteriorly. First it tapered to a string-shaped formation. On level with the dividing point of aorta, however, it again widened and forked into 2 parts that, judging by their appearance, reminded of a small primitive renal pelvis. There was no sign of any solid tissue capable of representing the renal parenchyma. The forking point of the process was surrounded by small amounts of loose adipose tissue, and from here it proceeded cranially a process, thick as a thin metal wire, that could not be followed up any further from the selected incision. It seemed to continue in direction of the anterior part of columna. As it was considered to be without interest to the patient that this process should be followed up, the string was caught with a pair of forceps, ligated and resected. No pulsation could be observed in the string.

From the wound the right renal region was palpated. No lower renal pole could be felt, neither any ureter other than the mentioned process.

After the bleeding had ceased a cigarette drain was placed at the vesical wall, and the wound sutured in layers. The operation lasted for 1 hour and 50 min.

On opening and inspection of the preparation the following was found:

The main tumor closely resembles a small bladder. It shows distinct trabeculation, and has a strong muscular wall. The wall measures 2—3 mm in section. Between the bladder and the above situated ureter there is a small valvular formation. The measure of the removed blad-

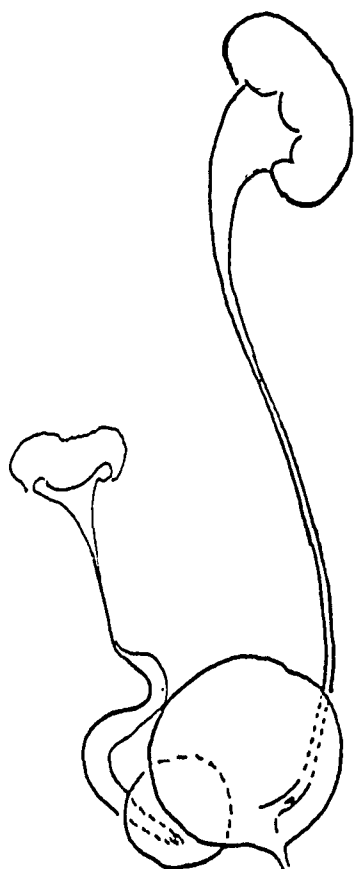


Fig. 1.

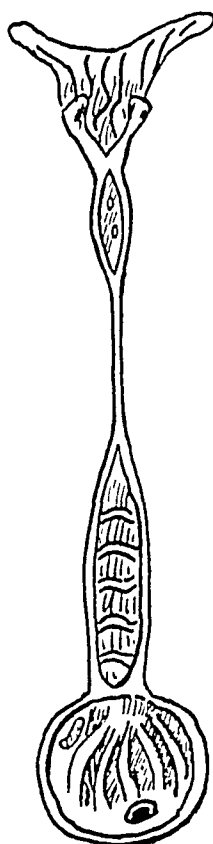


Fig. 2.

der when spread is 4 cm. Above the bladder there is a distended ureteral part, $6\frac{1}{2}$ cm long, 11 mm wide, when spread out. On the mucosal side of the spread ureter there are seen 5 transversal mucous membrane folds with regular interspaces of about 1 cm. Above the distended part the ureter is obliterated for a length of about $4\frac{1}{2}$ cm. Above this section the ureter again widens and spread out it measures 12 mm. The forked process, forming the cranial part of the ureter, feels firm and solid to touch, as a couple of pea-sized nodes. This solid part is presumed to be a primitive renal structure. The entire preparation from the caudal part of the bladder up to the cranial end of the preparation measures 22 cm.

Pathologic-anatomical examination of the preparation by prof. dr. med L. KREYBERG:

"Mounted preparation received, has been drawn and pieces removed. The preparation consisted of 3 parts: a 'bladder', a 'ureter' and at the top some irregular tissue in which was found a node about the size of a hemp-seed. Unfortunately the whole preparation was somewhat dried up. Sections from the bladder, traversing the largest trabeculae, reveal the surface to be covered by a transitional epithelium consisting of



Fig. 3.

several layers, most developed deep in one of the folds. For the rest are the trabeculae made up from smooth musculature with an inner longitudinal layer, constituting the main bulk, and an external narrower annular layer.

Sections from the more solid node show a number of epithelium-covered cavities, lined with a low, cubical to flat epithelium. The cavities contain a homogeneous mass. A couple of longitudinal sections showed the epithelial nuclei to be oval-round with a delicate chromatin mesh, pale. No glomerulus formation has been shown. The described ducts closely resemble the picture obtained of renal ducts in hydro-nephrosis, and have been interpreted as remnants of the part of the renal structure originating with the Wolffian duct.

Diagnosis: Vesica-ureter and partial renal formation."

KREYBERG (sign).

The first 2 days after the operation the patient had to be catheterized. Later micturition was spontaneous. There was no leakage of urine into the wound. But there was some infection and a limited fascial necrosis, and therefore some time lapsed before the wound closed up. On dismissal from the hospital, ¹²/₁₁, the wound had practically healed.

1 month after the patient had left the hospital he said to be very grateful to be relieved of a "suffering, almost beyond endurance", and that micturition now was perfectly normal, "even a pleasure".

We were very anxious to find out whether the small bladder had had any connection with the main one (such connection was, as mentioned in the report not demonstrable during the operation), and whether the small bladder had an outlet, eventually a urethra of its own, with an opening into the main urethra. Therefore cystoscopy was made twice, and urethrography twice.

At the 2 cystoscopies ($17/10$ and $6/11$) it was possible to ascertain that the already mentioned bulging into the right half of bottom of the bladder had disappeared. No sign of postoperative changes were indicable on the right side of the vesical mucous membrane, and thus a confirmation was obtained of the observation made during the operation, that no connection existed between the 2 bladders. It was now demonstrable that the trigone was only partly developed, as the right half side and the ureter fold on right side were lacking. In the normal site of these formations the bladder was quite smooth. In chromocystoscopy a strong blue jet was seen on the left side after $4\frac{1}{2}$ min., on the right side no blue color.

The results of the 2 urethrographies were as follows:

$30/10$: *Urethrography*: 20 cc of diluted urotrast (1:1). The outlines of urethra are everywhere smooth. Especially is there no contrast filling of any paraurethral ducts, that eventually might be suspected of representing a small extra-urethra. The filling of pars prostatica, however, is not quite satisfactory.

R.: Negative findings.

DENSTAD (sign.).

$1/11$: For if possible to obtain a more continuous filling of pars prostatica the urethrography was repeated, this time with thin iodized oil (20 cc). The filling is quite good, and no cul-de-sac nor rudimentary urethra is demonstrable. But to the right, and possibly somewhat posterior to the contrast-filled bladder there is a horizontal contrast-filled small duct, 1 cm long, thick as a needle, probably representing a connection between the extirpated small "extra-bladder" and the ordinary bladder.

R.: Narrow, short duct proceeding from right, posterior part of the bladder in lateral direction.

DENSTAD (sign.).

A distinction must be made between two kinds of double bladder. The one has been termed *vesica duplex*, and is recognizable by the presence of 2 separate cavities, each with a ureter and a urethra. The division into 2 separate cavities is in *vesica duplex* also noticeable from the external shape of the bladder. The other kind has been termed *vesica bipartita*. Characteristic is the normal and undivided external appearance of the bladder, whereas the cavity is divided by a more or less complete partition wall.

In the condition known as *vesica duplex*, the 2 bladders may be lying side by side, or one in front of the other. Also an hour-glassbladder with horizontal division has been described.

Double bladder is capable of being confused with other conditions, namely with diverticular formations, of which there are congenital and aquired forms. Because of this possibility of confusion it is difficult to obtain accurate informations as to the frequency of the double bladder. Most reports of double bladders are found in early publications, partly from section reports, partly from clinical observations, and many of these have been insufficiently described. It must be kept in mind that the first cystoscope was constructed by NITZE in 1876, but that it hardly was fit for general use before in 1898, when CHARLES PREESTON substituted the incandescent platinum wire and the cooling device with a "cold" lamp. Neither was the ureter-cystoscope, that had several forerunners before it was improved by ALBARRAN, very answerable and in use before the century end. Therefore it is reason to regard the early clinical observations sceptically.

At least it is a fact that vesica duplex as well as vesica bipartita are extremely rare conditions. According to EINAR LJUNGGREN, V. BLUM has in the literature collected 10 cases of vesica duplex (1929). BLUM's work has not been available to me. In the Scandinavian literature there are 2 informations, the one by EINAR LJUNGGREN (1932, vesica bipartita) and the second by C. A. LJUNGGREN (1897, vesica duplex). Besides EINAR LJUNGGREN's work there are in recent literature informations by HACHMEISTER (1941, vesica duplex, and also double vagina and bicornate uterus, healed fissure of the abdominal wall and symphyseal fissure), GREENBERG (1936, vesica bipartita). Of early works it may be mentioned CATHELIN and SEMPÉ. These authors have collected 15 cases of certain double bladder from the literature, and have themselves added 1 case, making a total of 16 cases. (Whether the same cases also appear in BLUM's material I am debarred from finding out.) Of these 16 cases, judging by the brief informations, only 5 were vesica duplex. CATHELIN and SEMPÉ stipulated the following characteristics for a double bladder in contrast to a diverticulum: 1) musculature of the double bladder wall is of normal thickness, and 2) a ureter opening in each bladder cavity. In contrast hereto the diverticulum has no ureter opening and an inconstant and uneven thickness of the musculature. — Another early information is derived from CARL SCHWARZ (1896, double bladder with the cavities situated one posterior to the other. He himself ventilated the possibility of the one "urine bladder" actually being a bag-shaped dilatation of the lower part of the

ureter). PAGENSTECHER (1904), REICHEL (1893), and CHWALLA (1927) discuss the probable mechanism of the formation of double bladders on a base, the solidity of which I have not sufficient knowledge to evaluate. For the rest a few publications exist, mostly of early date, and are found in the list of literature of the above authors, a literature that at present is not available.

The present case resembles none of those mentioned in the literature. It is characterised by a rudimentary right kidney and ureter and a right rudimentary bladder, the lower outlet of which was not demonstrable. Urethrography suggested an outlet entering into the bladder, cystoscopy was unable to point out any such communication. It may be thought that the opening might be situated in the vesical cervix, in a place of which the cystoscopy did not offer a clear view. Most interesting is the demonstration of the absence of glomeruli in the rudimentary kidney. History of the development of the urinary tract tells us that the ureter, the renal pelvis, ductus papillaris and pars colligens originate with the Wolffian duct, whereas Bowman's capsule, pars contorta, Henle's loop and pars intermedia derive from the metanephrogenic tissue. In the present case it thus appears that only the structures from the Wolffian duct have developed, whereas the metanephrogenic contribution to development of the kidney has failed. To explain the development of a rudimentary extra bladder is beyond the knowledge of the author. I may be permitted to mention what Professor K. SCHREINER kindly has informed me, namely that the Wolffian duct partakes in formation of the vesical trigone, whereas the remaining part of the bladder, as known, originates with cloaca. In the present case the possibility might therefore be ventilated, of a failure of fusion between the part of the right Wolffian duct, forming the right trigonal half, and the remaining part of the bladder.

Summary.

The author reports a case of double bladder in a man, 33 years old. The right urine bladder, ureter and kidney were rudimentary. No connection between the 2 bladders was demonstrable. The right bladder and the rudimentary kidney were removed in operation, and the patient was relieved for his symptoms, consisting of pain deep in nates. The rudimentary kidney microscopically showed no glomeruli nor other parts of metanephro-

genic origin, and it must therefore be presumed that it had been built up exclusively from tissue from the Wolffian duct.

Zusammenfassung.

Verf. berichtet über einen Fall von doppelter Harnblase bei einem 33jährigen Manne. Rechts waren Harnblase, Ureter und Niere rudimentär. Zwischen den beiden Harnblasen konnte keine Verbindung nachgewiesen werden. Die rechte Blase und die rudimentäre Niere wurden operativ entfernt, und der Kranke wurde von seinen Symptomen befreit, die in einem Schmerz tief im Gesäss bestanden. Die rudimentäre Niere zeigte mikroskopisch keine Glomeruli oder andere Teile von metanephrogenem Ursprung, und es ist deshalb anzunehmen, dass sie ausschliesslich aus dem Wolff'schen Gange entstammendem Gewebe aufgebaut war.

Résumé.

L'auteur relate un cas de vessie double chez un homme de 33 ans. A droite la vessie, l'uretère et le rein étaient rudimentaires. Aucune communication entre les deux vessies ne put être mise en évidence. La vessie de droite et le rein rudimentaire furent extirpés opératoirement, et le malade fut débarrassé de ses symptômes pathologiques, qui consistaient en une douleur profonde dans les fesses. Au microscope le rein rudimentaire ne montrait ni glomérules ni autres parties d'origine métanéphrogénique, de sorte qu'il faut supposer qu'il était constitué exclusivement par des tissus dérivés du conduit de Wolff.

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From the Copenhagen University Medical Clinic A
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 and Surgical Clinic C
 (Chief: Prof. E. DAHL-IVERSEN, M. D.)

The Clinical Picture and Treatment of Pheochromocytomas of the Suprarenal.¹

Two own cases, one with paroxysmal hypertension improved by treatment with methylthiouracil and cured by surgical intervention.

By

TAGE ESPERSEN & E. DAHL-IVERSEN.

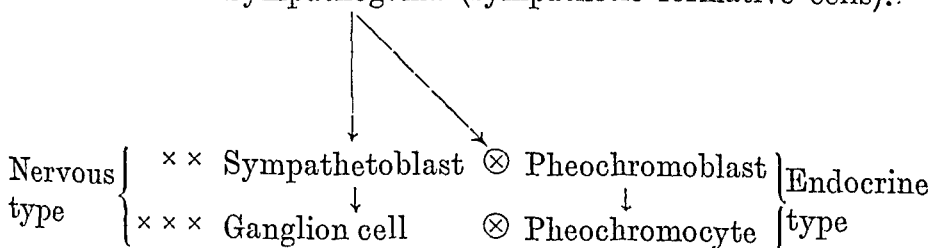
Introduction.

While some diseases can easily be rubricated either as decidedly medical or decidedly surgical, there are others which from their symptomatology must be characterised rather as medical but which, on account of their treatment, with equal or perhaps even greater right, belong in the surgical clinic. Under this category fall, among others, certain tumors of the adrenal medulla, the so-called pheochromocytomas or, as they are also called, paragangliomas or chromaffinomas.

Clinically, these tumors are divided into those which give hormonal symptoms and those that don't. Both types are derived from the same cell, the sympathetic formative cells (sympathogonia). On maturing, these differentiate into sympathetic ganglion cells and ripe medullary cells, pheochromocytes. The development will appear from the following schema:

Development of the medullary Cells.

× Sympathogonia (sympathetic formative cells)..



¹ Read at the meeting of the Danish Surgical Society on February 9, 1946.

Tumors from the adrenal Medulla.

- | | | |
|---|--------------------|--|
| × | Sympathogonionomas | } malignant; often developing during fetal life. |
| × | Sympathoblastomas | |
| × | × | } mostly benign. |
| × | Ganglioneuromas | |
| ⊗ | Pheochromocytomas | |

(Besides, mixed forms).

The pheochromocytoma is in other words the type of tumor which develops when there is an abnormal proliferation of the mature medullary cells. These tumors oftenest arise from the adrenal medulla, but can occur in any place where there is chromaffin tissue, for instance in the retroperitoneal tissue, along the abdominal aorta (especially corresponding to Zuckerkandl's bodies), and in rare cases intrathoracically (34). A distinction is therefore made between intra-adrenal and extra-adrenal pheochromocytomas.

The disease is rare. It occurs practically only in adults, with an approximately equal sex distribution, and a little oftener in the right side than in the left. According to BRUNSCHWIG & HUMPHREYS, there had up to 1940 been recorded 90 cases located to the suprarenal gland. According to KIRSHBAUM & BALKIN, the number had in 1942 risen to 100, and to these must by now be added at least 19, possibly more; owing to the present disturbed conditions it has been difficult to carry the registration up to date. Most of the cases have been necropsy-findings, however.

From the Scandinavian countries there has so far been reported 6 intra-adrenal cases diagnosed either clinically or by operation; namely, 1 from Norway in 1937, by BORCH-JOHNSEN, 1 from Sweden in 1939, by STRÖMBECK & HEDBERG, and from Denmark 3 in 1937 by HOLST and 1 in 1945 by GORTZ. Besides, a case found by necropsy has been reported by BERGSTRAND, in 1920.

Extra-adrenal pheochromocytomas are still more uncommon, and are not as often as the intra-adrenal accompanied by endocrinous symptoms. So far as we know, the total number of histologically verified, fully developed cases is only 15. Of Danish authors, GORMSEN (1938) and BINDSLEV (1941) have described such tumors.

In the literature, it has several times been stated that VOLHARD was the first to diagnose the disease, but this is not correct. The truth is that he in 1917 had two patients with hypertension and

albuminuria operated upon on suspicion of renal tumor, and as the symptoms in both cases disappeared after extirpation of the kidney and a large adjacent tumor, it has later been suggested that it had probably in fact been a question of pheochromocytomas. The characteristic clinical picture, with paroxysmal hypertension, was described for the first time in 1922, by LABBÉ, TINEL & DOUMER, and the clinical diagnosis first established by DONZELOT, in 1926. MAYO seems to have been the first to extirpate successfully a retroperitoneal tumor in a case where the typical syndrome was present, but the true nature of the neoplasm was not recognised. This was in 1927. Two years later, the first successful operation on the basis of a correct preoperative diagnosis was done by SHIPLEY, the diagnosis having been made by PINKOFFS. Of papers from recent years, reviewing the subject, there are, among others, WELLS & BOMAN's from 1939 and BISKIND, MEYER & BEADNER's from 1941.

Clinical Picture.

Clinically, the pheochromocytomas of the suprarenal gland manifest themselves in the great majority of cases by characteristic attacks of hypertension, and these were already by early observers associated with a recurrent paroxysmal hyperpinephrinemia, because the symptoms are precisely the same as those produced by epinephrine administered intravenously; namely, pallor, coldness, dilatation of the pupils, violent headache, palpitations, tachycardia, (sometimes bradycardia, though), stenocardia, sensation of choking, cardialgia, pains in arms and legs, nausea, vomiting (or, at least, tendency to vomiting), transient increase of blood pressure to 300 mm or more, and sometimes hyperglycemia, glycosuria and albuminuria. Also ptyalism and excessive lacrimation have been observed. When the attack is beginning to abate, there often comes a sensation of heat, perspiration and redness of the skin. These paroxysms, which may last from a few minutes to many hours (according to HYMAN & MENCHER as long as 36 hours), can be precipitated for instance by sudden movements, physical and psychic strain, and sometimes by palpation or massage of the suprarenal region, but they may also come on without demonstrable cause.

That the disease really has its origin in a hyperpinephrinemia

may probably be considered as proved. That the amount of epinephrine or epinephrine-like substances in the tumor has in several cases been found greatly increased — to as much as 40 mg per g of neoplastic tissue, as against normally 1 to 2 mg — probably does not say so very much in this connexion; what is more significant is that BEER, KING & PRINZMETAL in 1937 biologically could demonstrate a pressor substance with epinephrine-effect in blood removed during an attack.

Chemically, the blood epinephrine could for a long time not be determined, owing to the insufficiency of the methods. So far as we know, the results of such analyses have up to now been published only in connexion with two cases. In both, the blood epinephrine was found increased during attacks, but to very different extent. STRÖMBECK & HEDBERG found it in 1939, by VON EULER's method, increased over 1,000 times, while VOLHARD in 1944, by a modification of VON HUEBER's fluorescence method, found a content of twice the normal. Between the attacks, VOLHARD found normal values, STRÖMBECK & HEDBERG about 30 times the normal. It has also been suggested, though, that another factor besides the epinephrine might perhaps play a rôle in precipitating the attacks. Thus, GORTZ believes that the mere presence of the tumor has the effect of making the sympathetic nerve system excessively sensitive, by influence either through blood or perhaps rather through the nerves.

Diagnosis.

Typical attacks with paroxysmal hypertension should, of course, at once arouse suspicion as to the nature of the affection; but the paroxysmal hypertension may be very difficult to recognise, especially when the attacks, as it is often the case, are of brief duration; and it is in fact not surprising that in most cases the clinical syndrome of the disease has been misinterpreted. Most of these patients have gone from one physician to another, from hospital to hospital.

The determination of the blood epinephrine during the attack will probably also gradually become of diagnostic value when the chemical methods of analysis some day in improved and perhaps simplified form become adopted by the clinicians. The modification of the fluorescence method devised in 1941 by the Finnish

authors KALAJA and SAVOLAINEN may perhaps prove of service; it has been used in our cases.

The tumors are often small; they rarely become so large that they can be palpated. Owing to the anatomical conditions, those in the right side are particularly difficult to palpate, and tumors weighing at least 1,000 gm have been overlooked. According to the literature, the maximal weight is 2,000 gm. Sometimes it may be impossible to decide without operation whether a tumor is of the right adrenal gland or the left, but in other cases a roentgen examination may settle the question, for instance by showing a soft-tissue shadow under exposure without contrast medium or a dislocated kidney under urography. Also the pneumogram after perirenal insufflation of air may give valuable aid (CAHILL; MENCKER), and in one case (VOLHARD, 1944) roentgen examination of the extrabulbar portion of the duodenum has been attempted with positive result. The observed change in the configuration of the duodenum can, of course, only be found in the case of tumors of the right adrenal, however. In exceptional cases, calcium shadows in the adrenal region observed in an ordinary roentgenogram have shown the way (TENENBAUM). Massage of this region may be informative if the occurring attacks are precipitated only from one of the sides, but cases of misinterpretation have happened (McKENZIE & McEACHERN). In some cases, the hypertensive crises are absent, but there is a permanently increased blood pressure. If there then at the same time is albuminuria, and perhaps retinopathy, the disease may be confounded with nephrosclerosis and chronic nephritis. This condition is usually stated to occur in cases with a protracted course; still, there are examples of the symptoms having persisted for ten to fifteen years without resulting in the development of chronic hypertension (HEGGLIN & NABHOLZ; SHIPLEY; TENENBAUM).

In some cases, the symptoms have been taken for expressions of hyperthyroidism. In this connexion it may be mentioned that there was increased metabolism in 7 of the 16 cases in which we have found statements respecting the results of investigations on that point. In 3 cases, strumectomy was performed; in one of these the magnitude of the metabolism is not stated, but it is probably permissible to reckon with its having become increased, and that thus 8 patients, in all, of 17, have shown hypermetabolism. We have found mention of struma in 8 cases, in all. Other cases have been diagnosed variously as essential hypertension

or heart disease, especially coronary sclerosis, coronary thrombosis, cardioneurosis or paroxysmal tachycardia.

Prognosis.

As said above, the pheochromocytomas are as a rule benign morphologically; but physiologically they are malignant, and the prognosis, in the absence of surgical intervention, bad. The attacks are an enormous strain on the circulation and may be accompanied by great electrocardiographic changes. The cause of death will in most cases be cardiac insufficiency or cerebral hemorrhage, also in the cases in which chronic hypertension has developed.

Own Cases.

If one is to have a chance of diagnosing uncommon diseases, one cannot, in fact, be often enough reminded of their existence and of their clinical picture. We shall therefore relate two cases of our own. One of them is particularly interesting from the therapeutic point of view, and will therefore be spoken of in a following section, under "Treatment". The patient was a boy, 10 years old, with permanent hypertension due to a pheochromocytoma of the left adrenal; the first observed case of the disease in a child.

In the other case, there was paroxysmal hypertension, and the case, too, is particularly interesting for several reasons, among others by the fact that the first time the diagnosis was mistaken despite a characteristic anamnesis, and also because it is the first case in which the attempts to make the endocrinous symptoms recede by medical treatment have succeeded. Moreover, we succeeded in demonstrating unusual electrographic changes and increase of the blood epinephrine during attacks; and, last not least, for the first time in Denmark, in removing an intra-adrenal medullary tumor and carrying the patient through.

The patient was a factory-workman, 49 years old (journal no. 1032/45.) He was admitted for the first time to the medical dept. A of the State Hospital in Copenhagen from Dec. 28th, 1913, to March 10th, 1944, for angina pectoris. The diagnosis of the department was hyperthyroidism, perpetual arrhythmia and transient glyco-uria. In the two preceding years or so, he had had periodical attacks of

precordial pains accompanied by pounding, irregular heart action and headache, to which gradually came attacks also of nausea, tendency to vomiting and hiccoughs. Besides, he complained of increasing irritability and subjective sensation of heat.

The physical examination showed slight, diffuse struma, doubtful exophthalmus and perpetual arrhythmia without cardiac enlargement or murmur. Repeated measurements showed normal blood pressure, periodically there was slight glycosuria, and once the fasting blood sugar was much increased: 0.199 per cent. The metabolism was about 130 per cent, and the condition was interpreted as one of slight thyreotoxicosis. As diiodotyrosine had only slight effect, treatment with thiourea was tried, but had to be suspended after about 10 days, owing to high fever and the weak condition of the patient. There now followed a brief period during which there was noticeable improvement and fewer attacks; but then the condition again became worse, and after a diiodotyrosine treatment the patient was transferred to surgical dept. C, where subtotal strumectomy was done March 11th, 1944. The microscopic diagnosis was colloid struma without sure signs of hyperthyroidism.

Following the operations there was considerable improvement, and for four—five months the patient was entirely free from symptoms. But by the end of the summer the attacks returned, and as they gradually increased in violence and frequency, he was again admitted to medical dept. A on Sept. 25th (to Dec. 1 st, 1945), with the diagnosis Graves' disease.

He now described the attacks as follows. They began with violent pains and a sensation of compression across the chest, especially behind the sternum, often also up at the base of the throat. The pains were extremely distressing and often spread down into the epigastrium and out into the arms and legs, and there would often come a feeling of violent tension in the head, "as if it were going to burst". Sometimes the precordial pain would dominate, sometimes the pain in the head. This would be followed by rapid, pounding heart action, with a sensation of irregular heart beats and violent pulsation in the neck, often nausea, tendency to vomiting and hiccoughs. During severe attacks there would often be marked nophthalmia. At the end of the attack there would be a feeling of intense heat and transpiration; afterwards extreme fatigue. Usually, the attacks were of very brief duration, lasting only a few minutes or so; on the other hand he might have as many as up to thirty in a single day. As a rule, they would come on without any apparent cause, on holidays as on working-days; still, he had noticed a few precipitating factors, for instance that he could not wear anything tight about the waist, especially a belt. Often an attack would come on when he got out of bed, or if he stood straight up and down for some time. At the place where he worked, they occurred especially when he had to bend over in lifting or carrying anything heavy. He could not lie on his side in bed, especially not on his left.

The physical examination at admission this time showed at first

nothing abnormal except that the heart action at times was arrhythmic and rapid. The metabolism was normal, the blood pressure 120/80. Urine at first negative, later a few times slight albuminuria. Renal function and eye-background natural.

A series of electrocardiograms taken during this hospitalisation showed varying pictures: rapid action up to about 170 (during attacks) alternating with normal frequency; action now regular, now irregular; in some missing, in others numerous, P-waves; in others again auricular, nodal and/or ventricular extrasystoles. Once, dissociation with interference was found, a rare abnormality, which however has been observed twice before in connexion with pheochromocytoma (9, 19). These changes will be described in greater detail in another place. Roentgenologically, the heart was natural.

During his stay in the hospital, the patient had frequent attacks, up to as many as seven daily; but owing to their short duration nearly a couple of weeks went by before it became possible to get him examined in one. The paroxysm was over before the physician on duty could reach the ward, and when he arrived there would be nothing particular to observe; especially was the blood pressure always found normal or subnormal.

At least we succeeded, however, in getting him observed during attacks. He became deadly pale, his pupils dilated, and he had a tormented appearance. His face twisted, and if he lay in bed when the attack came on, he lifted his head from pillow and bent over forwards with pain, his whole body shaking. He had difficulty in speaking, but the respiration was free. At the end of the attack he became hot and perspired, then he breathed relieved, with a smile. Excessive salivation or lacrimation was not observed.

The pulse became rapid and very hard to the feel, and was oftenest irregular. For instance, the heart action was counted to 170, confirmed by electrocardiography. The blood pressure rose to a great height; on one occasion a reading of 300/150 mm Hg. was made (Fig. 1). After the attack it fell very rapidly, sometimes to subnormal values (lowest recorded, 68 mm), where it, as in Fig. 1, might remain for as long as an hour.

The blood sugar did not show any considerable increase during the attacks; several times values of about 0.125 to 0.135 per cent were found (depleted glycogen depots?) see, for instance, Fig. 1, where these values are marked by an x. At other times there would be a rise to from 0.157 to 0.176 per cent. A glucose tolerance test (Fig. 2) showed an increase of the blood sugar from 0.129 to 0.179 per cent in the course of thirty to forty-five minutes. After 90 minutes there was a fall to 0.100 per cent, then an attack began to set in with renewed rise to 0.172 per cent, whereupon there again, 15 minutes later, came a fall to 0.100 per cent. During the patient's last hospitalisation there was at no time demonstrated glycosuria, not even after tolerance test or in connexion with attacks.

All indications pointed to a chromaffin tumor as the cause of the paroxysms. On renewed examination of the abdomen there could now

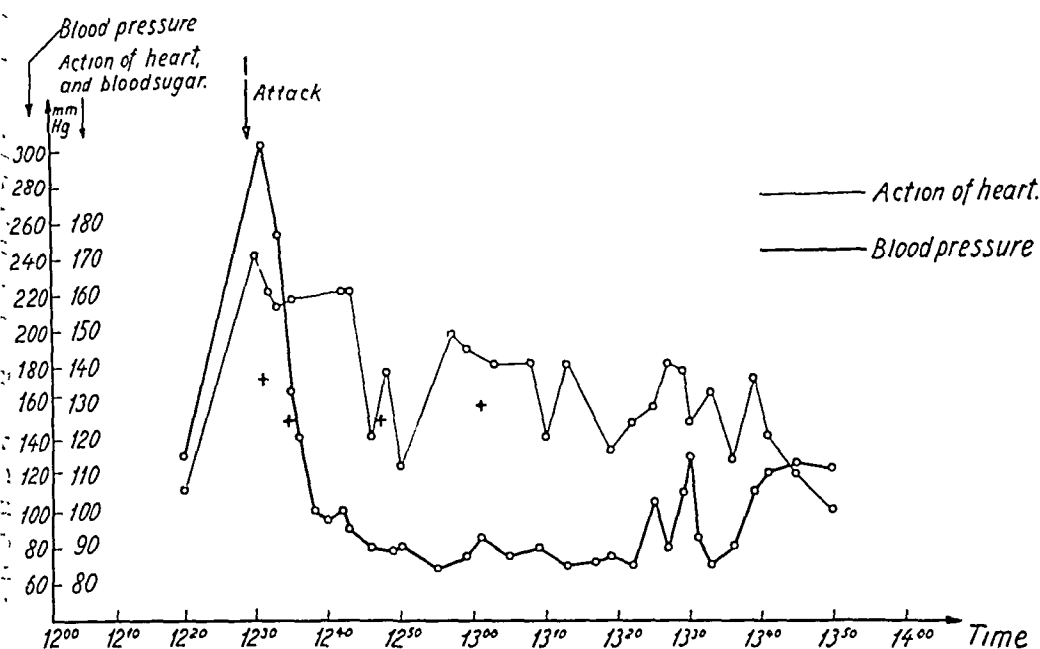


Fig. 1. Blood pressure, heart action and blood sugar values (the latter marked by an x) during an attack.

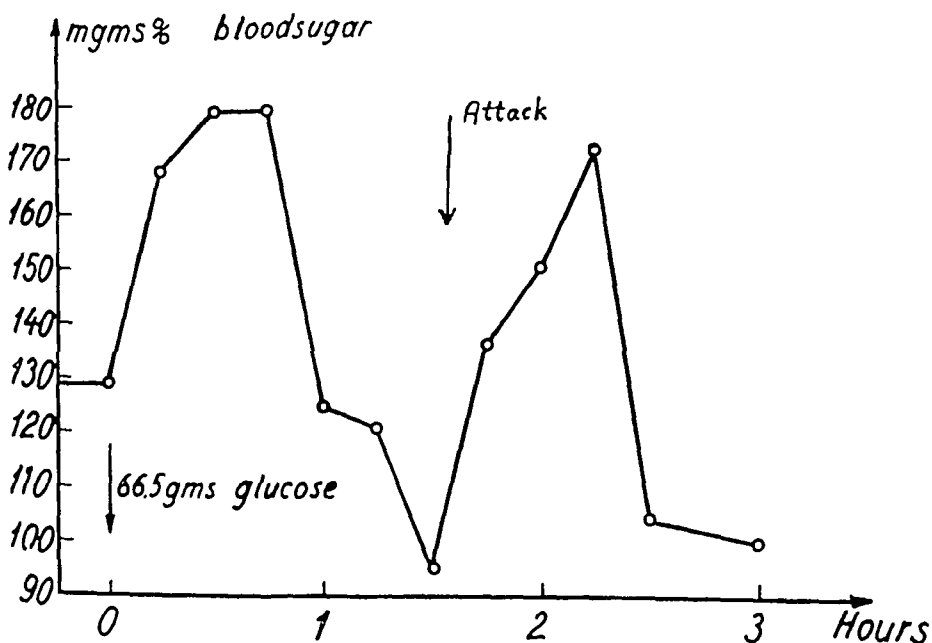


Fig. 2. Glucose tolerance test.

be felt an enlargement in the right flank. Palpation and cautious massage of the tumor region did not precipitate any attack. Intravenous urography did not succeed particularly well, but nevertheless seemed to show that something from above exerted a downward pressure on the right kidney and deformed the renal pelvis. Direct pyelography showed the right kidney displaced distally and somewhat laterally by a large extrarenal mass. The right renal pelvis lay on a level with the third lumbar vertebra.

Blood was taken for determinations of the adrenaline, which were made by Dr. WILKEN-JENSEN by the method devised in 1911 by KALAJA & SAVOLAINEN. It was found that during attacks the adrenaline content was increased four and a half to five times, while between the attacks the content was normal, or perhaps rather subnormal. It might perhaps have been expected that the deviations would have been greater, but the values found were of the same order of magnitude as those stated by VOLHARD. On the other hand, the difference from STRÖMBECK & HEDBERG's results was great.

After this there could be no doubt about the diagnosis pheochromocytoma in the right suprarenal region, nor about the treatment. The patient must be operated upon. But here hesitation was felt. He had daily attacks, and since the hypertensive crises are precisely one of the most serious risks in connexion with the operation, the question was if he could not in some way or other be made better fit for the latter by getting him into a period free from attacks. As said, he had been entirely free from symptoms for four—five months undergoing strumectomy, and there could hardly be any doubt that there was some connexion or other between this operation and the subsequent improvement. So far, we have found one parallel case, reported by BRUNSCHWIG & HUMPHREYS in 1940.

Curiously enough, it was independently of this observation that we began to treat the patient preoperatively with methylthiouracil. We had an idea that the effect which thiourea and allied substances has of inhibiting the formation of thyroid hormones in Graves' disease might possibly lie in preventing enzymic action, and that it therefore perhaps might be possible to check the formation also of other hormones than the thyroid. In the hope of being able to check the excessive production of adrenaline we therefore on Oct. 22nd began to give the patient methylthiouracil, 25 centigrams twice daily, with the result that from the seventh day of treatment, Oct. 28th, the attacks ceased, and when he a full month later was transferred to surgical dept. C they had not recurred. We had the impression that the tumor

grew during the treatment, because the circumference of his abdomen in the course of the month increased 4 cm, while the body weight remained constant. The outer conditions during the time he was given methylthiouracil were precisely the same as before, he was up and about, and not confined to bed.

Of course, it is by no means certain that it really was the formation of adrenaline that primarily got checked by the methylthiouracil treatment. It is perhaps more reasonable to think that it was a matter of direct effect on the hormone production in the remaining thyroid tissue. In that case, the supposed effect on the adrenal tumor should be thyreogenic, what probably also accords best with the general conception of the manner of action of the antithyroid substances, and is the simplest way in which the improvement in the condition following the strumectomy can be explained. Whether the supposed indirect checking of the adrenaline formation occurs through the medium of the hypophysis we are not prepared to say, but the possibility can hardly be excluded. Improvement has been observed also during pregnancy (9, 25). But wherever the point or points of attack may have lain there can be no doubt that in this case the strumectomy first, and later the methylthiouracil, had the effect of regulating the functional interaction of the endocrinous glands, which had been brought out of balance by the presence of the chromaffin adrenal tumor.

Treatment.

As it has already been said, there can only be one treatment of pheochromocytomas, namely extirpation as soon as the diagnosis has been established and the patient's condition permits. In the first of the cases which we relate here, we used, besides treatment with methylthiouracil, the preoperative treatment which we use when extirpation or resection of the adrenal gland is to be done on children with the genito-adrenal syndrome. This preoperative treatment is partly dieteic, partly medicamental, because surgical interference with the adrenal affects on the one hand the salt metabolism and the sugar resorption, on the other hand the blood pressure. Details respecting the dietary and the administration of preparations from the adrenal cortex have been given in a previous paper read before the Danish Surgical Society (see the *Acta Chirurgica Scandinavica* vol. XC, 210,

1944). In reviewing the literature, we have since found that a corresponding preoperative treatment is recommended by HYMAN & MENCHER, BISKIND and co-workers, and PERKINS and co-workers. BISKIND and his co-workers also recommend preoperative administration of adrenaline. Besides, it is recommended to give sedatives and to avoid anything that might have a harmful psychic effect on the patient, as, for instance, to speak with him beforehand about the operation; a principle which as we know may also be recommended in the case of patients with thyrotoxicosis.

As basal anesthetic, HYMAN & MENCHER recommend avertin, and for general anesthesia CAHILL recommends ether. We have used N_2O-O_2 -ether anesthesia. Spinal anesthesia is advised against both by WELLS & BOMAN and by McCULLAGH & ENGEL, on account of its tendency to lower the blood pressure, and with this we agree. As regards the operative technic, it is important that the approach be wide and the manipulation gentle, as pressure on the tumor may cause discharge of large amounts of adrenaline into the circulation, resulting in great increase of the blood pressure. It is not always, however, that pressure on the tumor has this effect. Where the tumor is small and it is known on which side it is situated, the lumbar incision is recommended, with resection of the twelfth rib. If necessary, also the eleventh rib may be resected, or merely cut across posteriorly. If it is not known on which side the tumor is situated, or if it is very large, the transperitoneal approach is advised. If the location is in doubt, there will in that case be question of midline incision, otherwise of a right or left transrectal incision.

STRÖMBECK & HEDBERG have pointed out that the fact that palpation of the tumor may cause the blood pressure to rise can be used as means of determining its side. This applies especially to the left side, where the liver does not interfere to make palpation through the intact abdominal wall difficult. If the vertical incision is not sufficient to permit the removal of the tumor, an incision, as long as necessary, must be made from the middle of the transrectal outwards, toward the side. In our case, the tumor was so large that this incision had to be lengthened toward the back, like a regular kidney incision, to the angle between the sacrospinal muscle and the twelfth rib. Besides, this rib had to be excised and the eleventh rib cut across posteriorly. Only thus was sufficiently free access obtained to the tumor, which weighed

1,140 grams when it came out. Its full weight was approximately 300 grams more, however; for during its removal a cystic portion of it had burst, whereby approximately 300 cc of bloody fluid became evacuated. Microscopy showed a benign pheochromocytoma. We have since in the literature found a somewhat similar incision employed by SHIPLEY. When the tumor is large, such an incision should be chosen primarily, instead of beginning with a transrectal. The patient is placed in half lateral position, so that the anterior axillary line is uppermost. The incision is made from the outer border of the rectus muscle obliquely backwards between the tenth and eleventh ribs, which posteriorly are resected for a short distance.

Before the operation, the blood pressure was 110/65. During the operation, infusion of saline solution was given in an ankle-vein. During the ligation of the vessels and the freeing of the tumor, the blood pressure rose to maximum 270, then fell to 80 as the mass was removed from the organism. After administration of 10 mg of percorten and a blood transfusion of about 500 cc it rose in the course of twenty minutes to 110/65. After the first 500 cc had run in, in the course of twenty minutes, a second transfusion was given, and from that time the pressure remained at preoperative, normal values. It did not become necessary to give adrenaline postoperatively. The case shows the importance of frequent control with the blood pressure during the operation, so that measures may be taken immediately when it becomes necessary. According to the literature, shock set in either during the operation or immediately following it, in over half of the cases operated on. Besides the measures we employed, also adrenaline may be used if necessary. It is given intravenously or, if indicated, as depot in oil. The authors cited in the foregoing recommend continuation of the preoperative regimen for some days following the operation. We do not believe this to be necessary, though, if the blood pressure is maintained after having been brought to a satisfactory level, and provided that the adrenal cortex, and perhaps the adrenal medulla, remains, as it did in our case. Therefore, we did not continue with the preoperative regimen following the operation. What is done in removing the tumor is to separate it from its bed after all the large vessels lying in the connective-tissue capsule, and which pass either to or from the surroundings, have been ligated. Several authors state that there is no large venous trunk or, for that matter, any vascular trunk

at all, there; nor was there any such in our case. In STRÖMBECK & HEDBERG's case, the ligation of the veins was associated with rise in the blood pressure, and the same was the case in our patient. They therefore recommend to omit this, and first to split the capsule and scoop out part of the tumor mass in order to counterbalance a rise in pressure, before applying the ligatures and removing the tumor. The procedure may be practicable in the case of small tumors, where it may be expected that the bleeding can be controlled in spite of such a method.

In our case, the right adrenal sat like a little Phrygian cap on the tumor. When the latter had been excorticated bloodlessly after preceding ligation of the vessels in the capsule, which were almost as thick as a little finger, the adrenal remained, with the entire mass of its cortex, but no medullary tissue was seen. It was as if the tumor had burst the gland at its base. After the tumor had been removed, the wound was closed, with drain leading out through its posterior angle. Because of the condition of his heart and the magnitude of the incision, the patient was kept in bed for six weeks. When he after that time got up, arrhythmia of the perpetual type set in, but disappeared entirely under treatment with digitalis. Two months after the operation he was discharged.

With regard to the location of the pheochromocytomas in the adrenal glands, BRUNSWIG & HUMPHREYS have in 1940 published a review of 103 cases, most of them necropsy cases. Only in a minor part of them was operation performed, and the operation mortality was large. We have not been able to obtain exact figures, but in 1938 MACKENZIE & McEACHERN stated that 20 patients with intra-adrenal pheochromocytomas had been operated upon with 25 per cent mortality from shock or other complications, and we have found, in 47 cases of intra- and extra-adrenal pheochromocytomas, including our own, a mortality of 26 per cent. As regards the distribution of the 103 tumors, 43 were found located to the right adrenal, 34 to the left, while 13 were bilateral. Finally, 13 were located outside the adrenal gland. In view of the possible bilaterality, or because the tumor may be situated right in front of the kidney or in front of the large vessels — what cannot be exactly determined from a lumbar incision — there may be reason to consider whether it would not be the best principle to chose the abdominal approach in *all* cases of pheochromocytoma. Moreover, one of the adrenals may be absent, and also of this the unilateral lumbar incision will

fail to give us any information. All these considerations, in connexion with a personal experience of our own, in 1944, makes us inclined to go in for the abdominal incision as preferable in these tumors irrespectively of their size, even when the location is known. The experience to which we have just referred concerned the case of a boy,¹ 10 years old, who had been ill for six months before admission.

The symptoms were headache and an increased blood pressure, the systolic varying between 210 and 265. There was albumin in the urine and hypertensive retinopathy. Urea-Clearance was normal, but the power of concentration slightly reduced. A single examination of the blood showed doubtful increased content of adrenaline. Roentgenologically, the heart was not found enlarged, and the electrocardiogram was normal. When transferred from the Queen Louise's Childrens Hospital to the State Hospital, surgical service C, the patient was very exhausted, perspiring and somnolent (the blood urea normal); in contrast to our procedure in the previous case, we therefore refrained from a several days' preoperative treatment. We had no support for assumption of an adrenal tumor except the permanently increased blood pressure and the doubtful increase in the blood adrenaline; neither did we know anything about the side of the tumor. Urography was negative with regard to dislocation of the kidney. Under the consideration that the left adrenal is the one which is oftenest the site of tumor formation — which, as we have seen, does not hold true as regards medullary tumors — we entered on the left side, with the patient under superficial N_2O-O_2 ether anesthesia. The respiration and pulse very soon become poor, so that stimulation with ephedrine and percorten at once had to be resorted to on account of fall in the blood pressure, which commenced already before the adrenal had been reached. The gland was laid free; it was found to be normal, nor could any tumor formation be found in front of the kidney or in the vicinity as far as the latter could be viewed or palpated. After this, the wound was closed, as it in view of the patient's labile condition was deemed inadvisable to go on and expose the other adrenal at the same time. Six hours afterwards, the patient died in a condition of falling blood pressure which stimulants, percorten and blood transfusion were incapable of raising. Whether the death was due to insufficiency of the peripheral or the cardiac circulation cannot be determined, as the venous pressure was not measured; but usually it is of shock the patients die. Necropsy revealed a pheochromocytoma, $4.5 \times 3 \times 2$ cm large, situated in front of the large vessels and by a pedicle connected with the lower mesial angle of the left adrenal gland — a location which could not be ascertained from the left side, and much less from the right, but which an abdominal incision would have disclosed. Microscopy of the tumor showed it to be a malignant pheochromocytoma, what also the necropsy had indicated, since it had shown invasion of the tumor tissue into a vein.

¹ Published by GORTZ, see Literature 14.

Summary.

The authors commence with an account of the development of the marrow cells and the different tumor forms corresponding to the different stages of development. Some of the most important data from the literature are given. Until now, about 120 cases of intra-adrenal and probably only 15 sure cases of extra-adrenal pheochromocytoma have been reported, most of them necropsy findings. The pathogenesis, symptomatology, diagnosis and differential diagnosis are reviewed, and the results of the surgical treatment mentioned. The operation mortality is high; of 46 cases operated on (those of the authors included), comprising both extra- and intra-adrenal pheochromocytomas, 12 (= 26 per cent) died.

The authors relate two cases of their own. In one of them, the patient was a man, 49 years old, with paroxysmal hypertension due to a benign pheochromocytoma of the right adrenal. The blood adrenaline was found $4\frac{1}{2}$ to 5 times increased during attacks. Treatment with methylthiouracil resulted in complete disappearance of the attacks. The tumor, which weighed about 1,400 grams, was removed with good result.

In the other case, the patient was a boy, 10 years old, with permanent hypertension due to a pheochromocytoma which operation through a left lumbar incision failed to demonstrate. The patient died 6 hours after the exploratory intervention probably from shock. Necropsy revealed a malignant pheochromocytoma ($4.5 \times 3 \times 2$ cm) situated in front of the large vessels and by a small pedicle connected with the lower mesial angle of the left adrenal.

The only treatment in these cases is extirpation as soon as the diagnosis has been established and the patient's condition permits. The authors recommend preoperative treatment as prior to extirpation of the adrenal gland. The reports in the literature as well as their own experiences lead the authors to think that there may be reason to consider whether it would not be the best principle to chose the abdominal approach in *all* cases of pheochromocytoma, irrespectively of the size of the tumor, and even when the location is known. When the tumor is large, they recommend to use Shipley's incision. One of the dangers involved by the surgical intervention is shock, which is counteracted by pericorten. blood transfusion and, if necessary, administration of adrenaline.

Zusammenfassung.

Einleitungsweise wird über die Entwicklung der Markzellen berichtet, sowie über die verschiedenen Tumorformen, die den verschiedenen Entwicklungsstadien entsprechen. Einige der wichtigsten Daten aus dem Schrifttum werden angeführt. Bisher liegen im ganzen etwa 120 intrasuprenale und wahrscheinlich nur 15 sichere extrasuprenale Phäochromozytome vor, die Mehrzahl derselben Sektionsbefunde. Die Pathogenese, Symptomatologie, Diagnose und Differentialdiagnose werden durchgenommen und die Ergebnisse der operativen Behandlung besprochen. Die Operationsmortalität ist hoch: von 46 operierten Fällen — eigene Fälle mitgerechnet — die sowohl extra- als auch intrasuprenale Phäochromozytome umfassten, starben 12, d. h. 26 %.

Zwei eigene Fälle werden besprochen. In dem einen Falle handelte es sich um einen 49jährigen Mann mit paroxysmaler Hypertonie infolge eines rechtsseitigen, gutartigen Nebennierenphäochromozytoms. Der Adrenalingehalt des Blutes wurde im Anfall auf das $4\frac{1}{2}$ —5fache erhöht gefunden. Nach Behandlung mit Methylthiourazil hörten die Anfälle gänzlich auf. Der etwa 1,400 Gramm wiegende Tumor wurde mit gutem Erfolg entfernt.

In dem zweiten Falle handelte es sich um einen 10jährigen Knaben mit permanenter Hypertonie infolge eines Phäochromozytoms, das bei Operation durch linksseitigen Lumbalschnitt nicht nachgewiesen werden konnte. Der Kranke starb 6 Stunden nach dem explorativen Eingriff, wahrscheinlich an Schock. Bei der Sektion wurde ein malignes Phäochromozytom ($4\frac{1}{2} \times 3 \times 2$ cm) nachgewiesen, das vor den grossen Gefässen gelegen und mittels eines schmalen Stieles mit dem unteren medialen Winkel der linken Nebenniere verbunden war.

Was die Behandlung anbelangt, gibt es nur eine: Exstirpation; sobald die Diagnose gestellt ist und der Zustand des Kranken es erlaubt. Präoperative Behandlung, wie bei Nebennierenexstirpation, wird empfohlen. An Hand des Schrifttums und eigener Erfahrungen wird angeführt, dass man allen Grund hat in Erwägung zu ziehen, ob man nicht bei sämtlichen Fällen von Behandlung von Phäochromozyton prinzipiell den abdominalen Schnitt wählen soll, unabhängig von der Grösse des Tumors und sogar bei bekannter Lokalisation. Bei grossen Tumoren wird der

Shipleysche Schnitt empfohlen. Eine der Gefahren des Eingriffes ist der Schock, dem man durch Percorten, Bluttransfusionen und evtl. durch Adrenalinadministration entgegenwirkt.

Résumé.

Le travail est introduit par un exposé du développement des cellules médullaires et une description des diverses formes de tumeurs correspondant aux différents stades de ce développement. Quelques unes des données principales de la bibliographie sont rapportées. Jusqu'à maintenant on a publié en tout environ 120 cas de Phœochromocytomes intrasurrénaux, et à vrai dire seulement 15 cas de Phœochromocytomes extrasurrénaux, pour la plupart des trouvailles d'autopsie. La pathogénie, la symptomatologie et le diagnostic, celui-ci également du point de vue différentiel, sont passés en revue, non sans parler des résultats du traitement chirurgical. La mortalité opératoire est élevée; de 46 sujets soumis à l'intervention — ceux des auteurs inclus — et comprenant aussi bien les Phœochromocytomes intrinsèques que les extrinsèques, 12, c'est-à-dire 26 %, sont morts.

Deux cas personnels sont rapportés. Dans l'un il s'agissait d'un homme de 49 ans atteint d'hypertension paroxystique causée par un Phœochromocytome de la surrénale droite. On constata que la teneur du sang en adrénaline était de $4\frac{1}{2}$ à 5 fois plus élevée que normalement, pendant les attaques. Celles-ci cessèrent complètement après le traitement par le Méthylthiouracile. La tumeur qui pesait environ 1,400 gr fut enlevée avec succès.

L'autre cas concernait un garçon de 10 ans avec une hypertension permanente due à un Phœochromocytome qu'on ne réussit pas à mettre en évidence à l'opération faite par incision lombaire gauche. Le malade décéda 6 heures après l'intervention exploratrice, probablement de shock. L'autopsie montra un Phœochromocytome malin ($4\frac{1}{2} \times 3 \times 2$ cm) situé en avant des gros vaisseaux et rattaché par un mince pédicule à l'angle inféro-interne de la surrénale gauche.

Quant au traitement, il n'y en a qu'un seul: l'extirpation, dès que le diagnostic est posé et si l'état du malade le permet. Le traitement préopératoire recommandé est le même qu'avant l'ablation d'une surrénale. En se basant sur la littérature et leurs propres expériences les auteurs ajoutent qu'il y a de bonnes

raisons de se demander si l'on ne devrait pas, dans le traitement des Phœochromocytomes, choisir par principe et dans tous les cas la voie abdominale, indépendamment de la grandeur de la tumeur, et cela même quand sa localisation est connue. Pour les tumeurs volumineuses ils conseillent l'incision de Shipley. L'un des dangers de l'intervention est le shock, contre lequel on agira par du Percortène, des transfusions sanguines, et éventuellement l'administration d'adrénaline.

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Über den Infektionsmechanismus bei chronisch rezidivierenden Staphylokokkenkrankheiten.

Eine klinisch-bakteriologische Untersuchung speziell über die Furunkulose und ihre Komplikationen.

Von

MATTI SULAMAA.

Einleitung.

Die Zunahme der eitrigen Entzündungen in Finnland in den letzten Jahren während der Kriege ist eine allgemein bekannte Tatsache. Die Infektionsfrequenz auch der sog. reinen Operationen übersteigt das friedenszeitliche Ausmass um ein Vielfaches (JÄRVINEN (1943), TORPPI (1945), und ebenso offenbar ist die Zunahme der chronisch rezidivierenden eitrigen Hautinfektionen, der Furunkulose und der impetiginösen Hautausschläge. Der Solitär-furunkel, obwohl auch er für seinen Träger sehr lästig ist, kann als eine Geringfügigkeit angesehen werden. Das Gleiche kann man indessen nicht von der sich von Woche zu Woche, von Monat zu Monat hinziehenden Furunkulose sagen, welche für jeden Arzt eine durchaus beachtenswerte Krankheit ist oder sein sollte, nicht nur wegen ihrer Geduld und Sorgfalt erfordernden, recht undankbaren Behandlung, sondern namentlich deshalb, weil der Patient bei fortdauernder Furunkulose der Gefahr einer Osteomyelitis und anderer Komplikationen allgemeineninfektiöser Natur ausgesetzt ist. Daher hat man, während gleichzeitig die Frequenz der Furunkulose gewachsen ist, in der klinischen Tätigkeit immer öfter mit ihren schweren, therapieresistenten Komplikationen zu tun bekommen. Die Therapie der Infektionen vom Typ

der Furunkulose besteht einerseits in Prophylaxe gegen ihre Komplikationen, und andererseits erfordert auch die Furunkulose an sich Beachtung und Behandlung ebenso gut wie jede beliebige andere Krankheit. Das Gelingen der Behandlung seinerseits ist wesentlich abhängig von der Kenntnis der Natur der Infektion. Aus diesem Grunde habe ich diese Fälle gewissermassen als Beispiele für die herabgesetzte Resistenz zum Gegenstand einer klinisch-bakteriologischen Untersuchung gewählt. Namentlich bei den chronisch rezidivierenden Infektionen genügt die Kenntnis der Art des Erregerbazillus nicht allein, sondern schon das Gelingen der Penicillinbiotherapie hängt wesentlich ab von der genauen Kenntnis der bakteriologisch-klinischen Natur der in Frage stehenden Krankheiten (GARROD, 1944).

Fragestellung.

Da hinsichtlich der die Pathogenität der Staphylokokken anzeigenden, gerade für den klinischen Gebrauch geeigneten bakteriologischen Untersuchungsmethoden Meinungsverschiedenheiten herrschen, bin ich gezwungen gewesen, meine Untersuchung auch auf die Spezifität der bakteriologischen Pathogenitätszeichen der Staphylokokken auszudehnen, um über den Wert der von mir angewandten Reaktionen persönliche Erfahrung zu gewinnen. Demnach habe ich versucht, mit meiner Untersuchung Klarheit über folgende Fragen zu bekommen:

1. Welchen praktischen Wert haben die einfachen, die Pathogenität der Staphylokokken anzeigenden Laboratoriumsversuche?

2. In welchem Masse zeigen die an chronischen oder chronisch rezidivierenden Staphylokokkeninfektionen leidenden Patienten klinisch nachweisbare Ursachen für die allgemeine Herabsetzung der natürlichen Immunität oder Folgen davon?

3. Zeigen die in den Eiterungen der Patienten angetroffenen Staphylokokkenstämme in den bakteriologischen Versuchen die Pathogenität an, oder können in diesen Fällen als Erreger auch solche Stämme in Frage kommen, welche in vitro weniger Virulenz zeigen?

4. Ist der erregende Staphylokokkenstamm der gleiche an verschiedenen Stellen des Körpers und in den zu verschiedenen Zeiten auftretenden Krankheitsherden. mit anderen Worten, ist die Quelle für die Reinfektion der gleiche Bakterienstamm, oder

werden die saprophytären Stämme wegen der herabgesetzten Resistenz pathogen?

5. Lässt sich die chronisch rezidivierende Natur dieser Krankheiten wenigstens teilweise vom bakteriologischen Standpunkt aus klären, so dass bei dem Patienten okkulte Quellen der Reinfektion nachgewiesen werden könnten?

6. Geben die bei der Untersuchung gemachten klinischen und bakteriologischen Feststellungen irgendwelche und was für Aufschlüsse über das Wesen der sog. herabgesetzten Resistenz?

7. Gehen aus den im Zusammenhang mit der Untersuchung gemachten Feststellungen nützliche therapeutische Gesichtspunkte hervor?

Über die klinische Pathogenität und die bakteriologischen Eigenschaften der Staphylokokken.

Die Pathogenität der Staphylokokken hängt hauptsächlich ab von den von ihnen ausgeschiedenen Exotoxinen, von welchen KOLMER und TUFT (1942) als die wichtigsten folgende erwähnen: Das Letal-, Dermonekro- und Hämotoxin, das Leukocidin, die Plasmakoagulase, das Fibrolysin und den Penetrationsfaktor. Das letale, das die Haut nekrotisierende und das Hämotoxin kommen bei den verschiedenen Stämmen im allgemeinen sowohl hinsichtlich der Stärke als auch der Antigeneigenschaften parallel vor (BLAIR, 1939), so dass viele Forscher sie für untereinander identisch gehalten haben. Die frühere Auffassung, dass ein Hämolyse aufweisender Stamm als solcher pathogen wäre, trifft trotz der obigen Feststellungen nur relativ zu, denn die Hämolyse zeigt nur einen toxigenen Stamm an. Pathogene Staphylokokkenstämme ohne Hämotoxinbildung sind nämlich oft angetroffen worden (CHAPMAN, 1938; DARANYI, 1926). Das von LOEB im Jahre 1903 gefundene Vorkommen der Plasmakoagulase parallel mit der Pathogenität hat als Erster MUCH (1908) wahrgenommen, und später haben u. a. CHAPMAN, CRUICKSHANK (1937), FLAUM (1938), DARANYI und CROSS (1927) diese Feststellung geprüft. Die Bildung von Koagulase, die bei den Staphylokokken eine sehr konstante Eigenschaft ist — konstanter als z. B. die Pigmentbildung oder die Hämotoxinproduktion — hat sich bei den pathogenen Stämmen in über 90 % als positiv erwiesen, während sie bei den meisten nicht-pathogenen Stämmen fehlte.

Der Nachweis der Toxinbildung in der klinischen Tätigkeit

beschränkt sich aus praktischen Gründen auf die Untersuchung des Hämotoxins und der Plasmakoagulase. Von den anderen für den einfachen Gebrauch geeigneten, in vitro festzustellenden Pathogenitätsreaktionen der Staphylokokken sind erwähnenswert nur die seit altersher bekannte Pigmentbildung und die Fähigkeit, Mannit zu zersetzen. Die Aureusstämme werden bekanntlich weit häufiger als Krankheitserreger angetroffen als die Albusstämme. Trotzdem gibt es sehr viele nicht-pathogene Aureusstämme, und die Albusstämme sind gar nicht so selten die Erreger der Krankheiten (BURNET (1930), BIGGER (1933)). Die Trennung zwischen Aureus- und Albusstämmen auf Grund der Pigmentbildung lässt sich ausserdem nicht immer ohne weiteres durchführen, weil Übergangsformen reichlich vorkommen (GAY, 1935), und die Deutung von der Methodik abhängig ist (BÖE, 1944). In der Praxis ist die Pigmentbildung dennoch eine relativ zugunsten der Pathogenität sprechende Eigenschaft (BLAIR). Die Zersetzung von Mannit ist eine bei ca. 90—95 % der pathogenen Staphylokokkenstämme festzustellende Eigenschaft (CHAPMAN, DUDGEON, 1908, HALLMAN, 1937, JULIANELLE, 1937, FLAUM), aber andererseits zersetzen auch zahlreiche (11—55 %) nicht-pathogene Stämme Mannit (CHAPMAN, THOMPSON, 1937). In der Praxis hält u. a. FLEMING (1944) die Plasmakoagulaseprobe für einen zur Indikation von Penicillintherapie genügenden Nachweis der Pathogenität, während WULFF (1945) die »hämolyisierenden und plasmakoagulierenden Staphylokokkenstämme« als pathogen anerkennt. BÖE, welcher feststellte, dass die Tierversuche ebensowenig wie die serologische Diagnose hinsichtlich der Staphylokokken auch nicht annähernd so sicher sind wie bezüglich anderer Bakterien, kommt dahin, die Pathogenität auf Grund der gleichen (vier) relativ beweisenden biochemischen Reaktionen zu beurteilen wie auch ich in meinem Material, nämlich auf Grund der Pigmentbildung, der hämolytischen, plasmakoagulierenden und mannitzersetzenden Fähigkeit. Er konnte nachweisen, dass die Reaktionen nicht einander folgen, und dass die Koagulaseprobe insofern am sichersten war, als von den koagulasepositiven Stämmen 97—98 % gleichzeitig positive Pigment- und Mannitreaktion ergaben, während wiederum die hämolytische Fähigkeit bei vielen plasmakoagulierenden und Mannit zersetzenden Stämmen negativ war. Die Pigmentbildung erwies sich neben der Hämolysinbildung als der unsicherste Massstab für die Pathogenität.

Die grosse Bakteriengruppe der Staphylokokken umfasst eine Menge verschiedener Stämme, deren eines Extrem der pigmentbildende, Hämotoxin und Koagulase produzierende, Mannit zersetzende pathogene *Staphylococcus aureus* darstellt, und das andere der weisse, nicht hämolytisierende, zur Mannitzersetzung unfähige, nicht-pathogene *Staphylococcus albus*. Wenn auch die Pathogenität und Nicht-Pathogenität dieser Extremformen ziemlich sicher sind, so ist die Differenzierung der in der Praxis anzutreffenden zahlreichen Übergangsformen auf Grund der in vitro auftretenden Eigenschaften in die Gruppe der pathogenen oder nicht-pathogenen immer in gewissem Grade relativ, wobei die Pigmentbildung, die Hämolyse, die Koagulase und die Mannitzersetzung zusammen die besten Grundlagen für die Differenzierung bilden.

Eigenes Material und Methodik.

Zur Gewinnung einer persönlichen Auffassung über die die Pathogenität der Staphylokokken relativ anzeigenden Eigenschaften habe ich aus Eiterproben, welche im Krankenhaus oder in der Poliklinik des Finnischen Roten Kreuzes bei der Operation von 150 an Panaritien und anderen eitrigen Entzündungen leidenden Patienten entnommen worden waren, den als Monoinfektion auftretenden, die Krankheit erregenden Staphylokokkustamm isoliert. Als Vergleichsmaterial zu diesen klinisch pathogenen Stämmen habe ich die an der Haut und der Nasenschleimhaut von 100 gesunden Personen anzutreffenden Staphylokokken isoliert, unter welchen sich natürlich auch tatsächlich pathogene Stämme befinden konnten, welche aber trotzdem in der Hauptsache als Saprophyten oder höchstens potential pathogen aufzufassen sein dürften. Die Proben wurden mit einem sterilisierten Wattebausch genommen, der unmittelbar danach in eine Ascitesagarröhre nach MACLEOD-REYMANN eingeschlossen und am gleichen Tag zur bakteriologischen Untersuchung gebracht wurde. Aus der Röhre wurden spätestens am folgenden Tage die Ausstriche sowie die Kulturen in Blutagar- und Phenolrotmannit-schalen hergestellt. Aus den Schalen, die 24 Stunden bei 37° im Thermostat gehalten wurden, wurden dann die Staphylokokkenkolonien zur Reinkultur entnommen, aus welchen dann weiterhin die Plasmakoagulaseprobe und die Impfung in Zuckerbouillonröhrchen vorgenommen wurde. Die Bildung von Säure

und Gas wurde hinsichtlich Glukose, Lactose, Saccharose, Maltose, Mannit, Kasein, Dextrin, Glycerin und Inulin untersucht. Aus den, von der Nase und der Haut entnommenen Proben mussten sehr oft mehrere Schalenkulturen hintereinander durchgeführt werden zur Isolierung der Staphylokokken von der übrigen Flora. Die gebrauchten Blutagarschalen wurden so hergestellt, dass eine dünne Blutschicht auf die Oberfläche des Agars gegossen wurde, wobei auch ein schwacher Hämolysering bei der Ablesung nach 2 Tagen deutlich wahrzunehmen ist.

Die Beurteilung der Hämolyse ist immer wesentlich abhängig von der Untersuchungsmethode. So zeigte sich z. B. bei vielen von meinen als hämolysen negativ betrachteten Stämmen in der Spur der entfernten Kolonie deutlich schwache Hämolyse. Indem ich nach einer für den klinischen Gebrauch geeigneten Methodik strebte, habe ich eine solche Positivität ausser acht gelassen. Die Plasmakoagulaseprobe wurde so durchgeführt, dass eine Öse voll rein kultivierten Staphylokokkenstamms 4—24 Stunden lang bei 37° im Thermostat auf das koagulierbare Plasma einwirken gelassen wurde, und die dabei entstandene deutliche Koagulation wurde als positiv angesehen. Während die Koagulasebildung bei den potential pathogenen Staphylokokken eine sehr konstante Eigenschaft ist, schwankt die Koagulierbarkeit des Blutplasmas bei den verschiedenen Tier- und Menschenindividuen (WILSON SMITH, HALE, 1944), ja sie kann sogar sich schnell verändern, wie ich bei einem meiner Fälle feststellen konnte. Nach CRUICKSHANKS Instruktionen verwendete ich bei den Versuchen das Plasma von Patienten, die sich erst kürzlich von einer schweren Staphylokokkeninfektion erholt hatten, wobei sich jedoch nur durchschnittlich jedes vierte Plasma als koagulierbar erwies, und ausserdem zeigten sich in der Koagulationsstärke beträchtliche Unterschiede.

Das Vorkommen der verschiedenen Staphylokokken saprophytischer Natur an der Oberfläche des menschlichen Körpers.

Auch auf der Haut gesunder Menschen werden fast ausnahmslos Staphylokokken angetroffen, deren Form und Eigenschaften meistens dem von WELCH im Jahre 1891 beschriebenen *Staphylococcus epidermidis albus* oder dem Schorfstaphylokokkus von GORDON entsprechen (TOPLEY, WILSON, 1931). KOCH stellte

1908 fest, dass 3—5 % der Staphylokokken der Haut Aureusformen sind, welche sich gleichzeitig oft als pathogen erwiesen. Der von LEXER (1936) als Erreger von Furunkeln erwähnte *St. citreus* wird im allgemeinen von den Staphylokokken als am wenigsten pathogen betrachtet (GAY). Auf den Schleimhäuten gesunder Personen werden gewöhnlich weisse Staphylokokken angetroffen, und der Befund ist gewöhnlicher in der Nase als im Rachen. THOMPSON und KHORAZO (1937) stellten unter Staphylokokken, die in 191 Fällen von Normalschleimhäuten isoliert worden waren, 21 % solche fest, welche Zeichen von Pathogenität *in vitro* aufwiesen, und HALLMAN seinerseits wies 40—60 % von den in der Normalnase angetroffenen Staphylokokken auf Grund der Koagulaseprobe als potential pathogen nach.

Bei 100 von mir untersuchten gesunden Personen wurden von der Haut 66 Staphylokokkenstämme isoliert und von der Nasenschleimhaut 64 Stämme. Relativ zugunsten der Pathogenität sprechende Eigenschaften traten bei ihnen folgendermassen auf:

	A. Haut				B. Nase			
Aureusformen	10	%	(BÖE	55 %)	33	%	(BÖE	64 %)
Koagulasepositive	12	%	(»	8.5 %)	29	%	(»	60 %)
Hämolysepositive	32	%	(»	40 %)	43	%	(»	70 %)
Mannitpositive	31	%	(»	40 %)	52	%	(»	60 %)

Von diesen Eigenschaften waren gleichzeitig positiv:

3/3 oder 4/4 ¹	7 %	24 %
2/3 » 3/4 oder mehr.	23 %	46 %
1/3 » 2/4 » »	43 %	59 %
Alle negativ	57 %	41 %

Häufiger als ich und viele andere Autoren (THOMPSON, KHORAZO) hat BÖE pathogene Eigenschaften bei den von gesunden Schleimhäuten isolierten Stämmen angetroffen. Der bedeutendste Unterschied zwischen BÖES und meinen Feststellungen betrifft die Pigmentbildung. Dies beruht darauf, dass ich wie auch die meisten anderen Autoren als Grundlage für die Differenzierung das für den klinischen Gebrauch besser geeignete, sofortige Aussehen der Kolonie genommen habe, während BÖE dagegen versucht hat, auch die kleinste, verspätete Pigmentproduktion nachzuweisen. Die Übereinstimmung in folgender Tabelle spricht zu-

¹ Wegen vorübergehenden Mangels an koagulierbarem Plasma konnte die Plasmakoagulaseprobe von vielen Stämmen nicht durchgeführt werden. Die Beurteilung gründet sich in diesen Fällen nur auf die Bildung von Pigment und hämolytischen Toxins sowie auf die Fähigkeit, Mannit zu zersetzen.

gunsten der von mir angewandten gröberen Art der Pigmentschätzung, weil die Aureusfarbe in den wirklich pathogenen Stämmen auch sofort makroskopisch ganz deutlich ist.

Grob schematisch genommen lässt sich von meinen Feststellungen zusammenfassend sagen, dass auf Grund der gebrauchten, nach der Literatur relativ für Pathogenität sprechenden biochemischen Reaktionen von den an der menschlichen Haut angetroffenen Staphylokokken ca. $\frac{1}{5}$ und von den in der Nase angetroffenen Staphylokokken nahezu die Hälfte deutlich potential pathogen sind, d. h. mindestens $\frac{2}{3}$ oder $\frac{3}{4}$ von den in Frage stehenden Reaktionen erwiesen sich als positiv.

Das Vorkommen der verschiedenen Staphylokokken als Erreger von Eiterungen.

Die Pathogenität der Bakterien ist auch als Gesamtheit ein etwas relativer Begriff, weil die Erregung der Krankheit immer, auch wenn man die Ansteckungsweise ausser acht lässt, die Funktion zweier Faktoren ist, nämlich der Resistenz des Patienten und der Virulenz der Bakterien. Da es jedoch nicht wahrscheinlich ist, dass solche alltägliche, gewöhnlich traumatisch bedingte Eiterungen wie die Panaritien u. dergl. zu ihrer Entstehung eine im Vergleich zum Durchschnitt beträchtlich herabgesetzte Resistenz voraussetzen, so kann man meines Erachtens die aus ihnen isolierten Staphylokokken mit vollem Recht als klinisch pathogen ansehen. In einem entsprechenden Material stellte WULFF hämolysierende und plasmakoagulierende Staphylokokken in 80 % der Fälle als Erreger fest, während die übrigen meistens von Streptokokken hervorgerufen waren.

Hinsichtlich ihrer relativ die Pathogenität anzeigenden Eigenschaften verteilten sich die von mir aus 150 akuten Eiterungen isolierten Staphylokokken folgendermassen:

Aureusformen	90 % (BÖE 90 %)
Koagulasepositive	92 % („ 88 %)
Hämolysesepositive	66 % („ 79 %)
Mannitpositive	93 % („ 88 %)

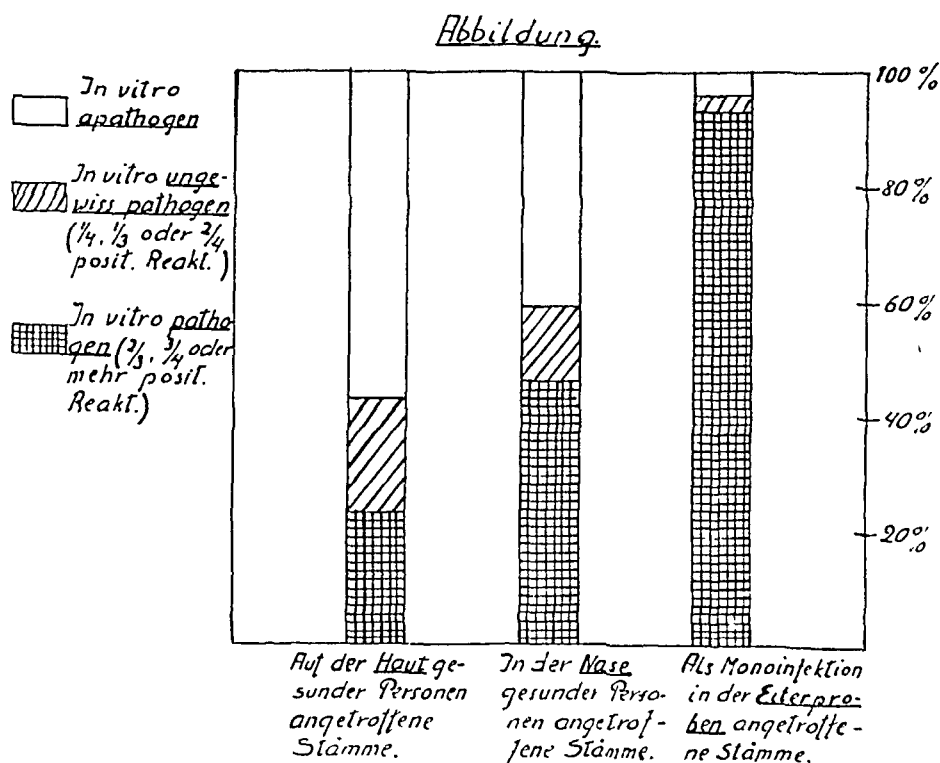
Von diesen Eigenschaften waren gleichzeitig positiv:

3/3 oder 4/4	60 % (BÖE 60 %)
mindestens 2/3 oder 3/4	93 % („ 76 %)
„ 1/3 „ 2/4	96 % („ 80—95 %)
0/3 oder 0/4	4 % („ 8,5 %)

Alle Pathogenitätsreaktionen waren gleichzeitig negativ in 6 Fällen, davon ein infiziertes Atherom, 3 benigne Abszesse und 2 Hidradenitiden. In 93 % der Fälle waren gleichzeitig mindestens $\frac{2}{3}$ oder $\frac{3}{4}$ von diesen Reaktionen positiv und in 60 % sämtliche. Da ich nur die als Monoinfektion aufgetretenen Fälle berücksichtigt habe, muss man die sich in den Versuchen negativ verhaltenden St. albusstämme für die Erreger der in Frage stehenden Eiterungen halten. Dadurch, wie auch in Böes Material, wird nur die Relativität der in Frage stehenden Reaktionen bewiesen.

Praktische Erwägungen über die Bedeutung der bakteriologischen Pathogenitätsreaktionen.

Die klinisch als Saprophyten an der gesunden Haut und an der Schleimhaut der Nase sowie klinisch pathogen in Eiterungen angetroffenen Staphylokokken verhalten sich in den Hämolyse-, Mannit- und Koagulaseversuchen sowie in der Pigmentbildung in der Weise, wie die folgende Abbildung als anschauliche Zusammenfassung zeigt.



Da sich die auf der gesunden Haut oder der Schleimhaut anzutreffenden pigmentbildenden hämolyse-, mannit- und koagulase-positiven Staphylokokken nicht als nicht-pathogen nachweisen lassen, und da solche Stämme andererseits die gewaltige Mehrheit der Erreger von Eiterungen ausmachen, so dürfte man in der Praxis derartige Staphylokokken mit ziemlicher Sicherheit als tatsächlich pathogen ansehen können. Bei denjenigen Stämmen, die nur zwei oder eine positive Reaktion aufweisen, bleibt die Pathogenität nach den bakteriologischen Versuchen ungewiss. Die Koagulaseprobe ist, sofern das als Indikator benutzte Plasma sich bei der Kontrolle als leicht koagulierbar erwiesen hat, als spezifischer anzusehen als die Mannit- und Hämolyseprobe sowie die Pigmentbildung.

Die sog. herabgesetzte Resistenz im Lichte der chronisch rezidivierenden Krankheiten vom Typus der Furunkulose.

Material und Methodik.

Das Material umfasst klinische und bakteriologische Feststellungen über 60 an rezidivierenden Hautinfektionen sowie deren Komplikationen leidenden Patienten, welche im Krankenhaus oder der Poliklinik des Finnischen Roten Kreuzes behandelt worden sind. Indem ich mein Augenmerk in der Hauptsache den Krankheitsformen vom Typus der Furunkulose zugewandt habe, deren richtigere Bezeichnung nach JADASSON Staphylodermia follicularis profunda ist, habe ich von den übrigen Staphylodermien nur die schwereren in mein Material aufgenommen, diejenigen, welche das chirurgische Krankenhaus belasten, also die langwierigen und rezidivierenden, die mehr generalisierten, Eiterbläschen, Pusteln, Schorf und impetiginisiertes Ekzem sowie ziemlich oft auch oberflächliche Ulzerationen vom Typus Ectyma simplex aufweisenden Fälle. Ausser der üblichen klinischen Untersuchung ist in den meisten Fällen der Blutsenkungswert, das Blutbild und der Blutzucker bestimmt worden, und bei einem Teil der Fälle wurde auch eine ergänzende Glukosebelastungsprobe durchgeführt. Die bakteriologischen Untersuchungen wurden, wie auch bei den oben erwähnten Fällen, im Sero-Bakteriologischen Institut der Universität Helsinki vorgenommen. Die Proben wurden mit einem Watteschwamm aus den Eitersekreten der Eiterbeulen, der gesunden Haut

sowie der Schleimhaut der Nase und des Rachens genommen. Die so infizierten Pinsel wurden unmittelbar in die Nährbodenröhre von MACLEOD-REYMANN eingeschlossen und in der früher erwähnten Weise untersucht.

Das klinische Bild und die disponierenden Faktoren der chronisch rezidivierenden Staphylokokkeninfektionen.

Nach dem Alter und dem Geschlecht verteilen sich meine Fälle folgendermassen:

Alter	Männer	Frauen	Zusammen
0—20 Jahre	3	—	3
21—40 »	31	11	42 (70 %)
40— »	13	2	15
Zusammen	46 (77 %)	13	60

Obwohl mein Material verhältnismässig klein ist, so scheint es doch offenbar zu zeigen, dass die chronisch rezidivierende Staphylokokkeninfektion vom Typus der Furunkulose nicht von den gleichen mit dem Alter der Pubertät und des Klimakteriums verbundenen innersekretorischen Störungen abhängt wie z. B. die Acne. Wie auch JADASSOHN (1938) erwähnt, scheint das männliche Geschlecht aus irgendwelchen Gründen für Krankheiten dieser Art empfänglicher zu sein.

Die Einteilung der Staphylopyodermien auf Grund des klinischen Bildes und desgleichen die Nomenklatur der Krankheits-typen ist bei den verschiedenen Forschern nicht die gleiche. Bei meiner unten folgenden Einteilung habe ich in der Hauptsache die Prinzipien von JADASSOHN und MUCHA (1934) befolgt. Vom allgemeinätiologischen Standpunkt aus habe ich meine Fälle demnach in zwei Hauptgruppen eingeteilt. Zur ersten Hauptgruppe A habe ich diejenigen Fälle gezählt, in deren Krankheitsbild nachweisbare disponierende oder provozierende Faktoren auftraten, und in die zweite Hauptgruppe B diejenigen, bei welchen die Infektion an sich bei einer sonst scheinbar ganz gesunden Person die Krankheitsform bestimmte. Nach dem klinischen Typ habe ich weiterhin die Fälle der beiden Hauptgruppen in 4 Untergruppen eingeteilt, indem ich gleichzeitig in der A-Gruppe das Verhalten der Dispositionsfaktoren in den verschiedenen Typen berücksichtigte. Demnach verteilten sich meine Fälle in der Weise, wie aus den folgenden Tabellen 1 und 2 hervorgeht.

Tabelle 1.

Hauptgruppe A, 19 Fälle.

	Diabetes mellitus oder vor- übergehend gestiegener Blutzucker	Kachexie Anämie u. dergl.	Lokal di- sponierende Faktoren ¹	Zusammen
1. <i>Typische chronisch rezidivierende Furunkulose</i> , gewöhnlich gleichzeitig 1—3 Eiterbeulen verschiedenen Stadiums	2	1	2	5
2. <i>Staphylodermia bullosa</i> , <i>crustosa</i> , <i>impetiginosa</i> s. <i>echymatosa</i>	2	—	6	8
3. Schwach reagierender <i>Furunculus multiplex</i> , gleich- zeitig zahlreiche Eiterbeulen gleichen Stadiums	—	3	—	3
4. <i>Carbunculus</i> , rezidivierend oder abwechselnd mit Fu- runkeln	2	1	—	3
Zusammen	6	5	8	19

Tabelle 2.

Hauptgruppe B, 41 Fälle.

1. <i>Typische chronisch rezidivierende Furunkulose</i>	31 Fälle
2. <i>Staphylodermia bullosa</i> , <i>crustosa</i> , <i>impetiginosa</i> s. <i>echymatosa</i>	4 „
3. <i>Furunculus multiplex</i>	2 „
4. <i>Carbunculus</i>	3 „
<i>Dermatitis pustulosa pyämica</i> , im pyämischen Stadium der Osteomyelitis	1 Fall
Zusammen	41 Fälle

Die in beiden Hauptgruppen an erster Stelle aufgeführte Gruppe »chronisch rezidivierende typische Furunkulose«, die ich wegen ihrer abweichenden Krankheitsnatur von den multipeln Furunkeln abgetrennt habe, ist in meinem Material die ungleich grösste, indem sie in der Hauptsache sonst ganz gesunde Patienten um-

¹ Als lokal disponierende Faktoren habe ich berücksichtigt: Verschiedene post-traumatische, post-thrombotische und varikotische Zirkulationsstörungen, auf den Beruf oder sonst schlechte Hygiene zurückzuführende Feuchtigkeits-Mazerationen, durch Jucken hervorgerufene, wiederkehrende Kratzläsionen usw.

fasst. Für diese Patienten ist die chronische Rezidivierung der Furunkel charakteristischer gewesen als das gleichzeitige Vorkommen zahlreicher Eiterbeulen. Bei ihnen unterscheidet sich auch die einzelne Eiterbeule von dem vorübergehenden Furunkel einer gesunden Person insofern, als sie trotz ihres geringfügig aussehenden Beginns sich langsam aber sicher zu einer umfangreichen Infiltration entwickelt, deren »Reifung« zum Eiter und Perforation an die Oberfläche bedeutend langsamer ist. Die endgültige Zentralnekrose ist im Vergleich zu der Entzündungsreaktion der Umgebung umfangreich und ihre Heilung langsam. Wenn neben dem Furunkel ein zweites erscheint, bleibt dies nicht, wie bei den gesunden Personen, kleiner als das erste.

Als zweite klinische Typusgruppe sowohl in Hauptgruppe A als auch B umfassen die erwähnten Staphylodermien trotz strenger Auswahl ein Fünftel meiner Fälle, und ihre Mehrheit gehört zu der offenbare disponierende Faktoren aufweisenden A-Gruppe. Das Krankheitsbild dieser extrafollikulären Hautausschläge wurde im allgemeinen von Vielförmigkeit beherrscht, so dass der gleiche Patient gewöhnlich gleichzeitig rein epidermale Eiterfollikel, Schorf oder impetiginisiertes Ekzem sowie epidermocutane oberflächliche Ulzerationen vom Typus *ecthyma simplex* hatte, ausnahmsweise auch Cutan- oder Subcutanabszesse. Bei der Wahl der Fälle ist die Chronizität entscheidend gewesen, insofern, als diese Fälle umgekehrt wie die gewöhnliche staphylogene Impetigo weder bei klinischer noch bei ambulatorischer Behandlung im Verlauf der zwei ersten Wochen Neigung zum Heilen zeigten, sowie das mehr oder weniger deutlich generalisierte Auftreten der Ausschläge auf der Haut.

Als dritten klinischen Typ in beiden Hauptgruppen habe ich umgekehrt wie die meisten anderen Autoren den multipeln Furunkel von der typischen Furunkulose abgetrennt, weil bei diesen Patienten die chronische Rezidivierungsneigung ganz offensichtlich geringer ist. Die entzündliche Gewebsreaktion rings um die Eiterbeulen im Verhältnis zu der zentralen oft sogar decubitusartigen Gewebsnekrotisierung zeigte desgleichen, namentlich bei den zur A-Gruppe zählenden Fällen, im Vergleich zu der an sich schon schwachen Reaktion der »typischen Furunkulose« deutlichen Unterschied. Das plötzliche Auftreten zahlreicher gleichartiger Furunkel erregt den Verdacht der Möglichkeit einer hämatogenen Art der Ausbreitung, was auch DANBOLT (1944) in gewissen Fällen nicht für ganz unmöglich hält, während er nach-

weist, dass die Furunkel im allgemeinen durch äusserliche Ansteckung entstehen und durch Vermittlung der Kontakt-Infektion verbreitet werden. Andererseits spricht indessen das gewöhnliche Auftreten der multipeln Furunkel an einem bestimmten Körperteil, z. B. am Rücken, zugunsten der Kontaktinfektion.

Der Karbunkel, den die meisten Forscher als ein Konglomerat zahlreicher nebeneinander liegender Furunkel, andere wiederum als eine ganz verschiedenartige Krankheitsform auffassen, kann gut den multipeln Furunkel gleichgestellt werden, von welchen er sich wesentlich nur hinsichtlich der Lage der verschiedenen Eiterbeulen nebeneinander unterscheidet. Die hämatogene Art der Ausbreitung wirkt bei den Karbunkeln nicht wahrscheinlich. Dagegen ist der in der Hauptgruppe B zuletzt aufgeführte einzelne Fall von Dermatitis pustulosa im pyämischen Anfangsstadium der Osteomyelitis in meinem Material die einzige wahrscheinlich hämatogen entstandene Dermatose. Sie hätte als Hautkrankheit nicht verdient mitgenommen zu werden, wenn nicht das Krankheitsbild der komplizierenden Osteomyelitis herabgesetzte Resistenz angezeigt hätte.

Von den disponierenden Faktoren, die bei einem Teil der Fälle meines Materials festzustellen waren, erfordern die sich mehr oder weniger der Kachexie annähernden Zustände und die erwähnten »lokalen Ursachen« keine weitere Erklärung. Dagegen scheinen der manifeste oder latente Diabetes mellitus sowie die während der Krankheit festgestellten vorübergehend gestiegenen Blutzuckerwerte bei der Klärung der Pathogenese der für diese Fälle charakteristischen herabgesetzten Resistenz Aufschlüsse zu geben. Aus RICHTERS (1936) Untersuchungen wissen wir, dass bei den Karbunkelpatienten im schlimmsten Stadium der Krankheit die Zuckerwerte des Blutes und auch des Harns vorübergehend erhöht sein können, obwohl bei dem Patienten vorher oder nachher nicht einmal latenter Diabetes nachgewiesen werden konnte. RICHTER begnügt sich damit, auf Grund seiner Beobachtungen die nahen gegenseitigen Beziehungen der Krankheiten vom Typus der Furunkulose und des Kohlehydratstoffwechsels festzustellen, und er warnt davor, derartige Patienten zu leicht als Diabetiker zu verurteilen. In meinem Material sind die Blutzuckerbestimmungen sowie bei Bedarf die Glukosebelastungsproben (1 g Glukose auf 1 kg Körpergewicht) wegen praktischer Schwierigkeiten nur bei reichlich $\frac{2}{3}$ der Fälle durchgeführt worden, und zwar nach dem Verfahren von CRESELIUS-SEIFERT,

wobei auf Grund von bei gesunden Personen durchgeführten Kontrollbestimmungen über 0.150 % steigende Blutzuckerwerte sowie über 0.250 % steigende Glukosebelastungswerte als pathologisch betrachtet wurden. Dabei wurden bei 6 Patienten erhöhte Werte angetroffen, was 10 % entspricht, welche Verhältniszahl ungefähr den Feststellungen der anderen Autoren bei Furunkulosen entspricht. Nur ein Karbunkelpatient hatte schweren manifesten Diabetes, während dagegen in nicht weniger als drei Fällen (1 Karbunkel, 1 typische Furunkulose und 1 Staphylo-*dermia* *echtymatosa*) bei der späteren Kontrolluntersuchung nach Heilung der Krankheit völlig normales Verhalten bei den Blutzuckerbestimmungen und den Glukosebelastungsproben festgestellt werden konnte. Bedauerlicherweise konnten die Kontrollbestimmungen an den 2 übrigen Patienten nicht ausgeführt werden. Auf Grund dessen scheint der wirkliche Diabetes in der Ätiologie der furunkeltypischen Krankheiten als disponierender Faktor seltener zu sein, als früher im allgemeinen angenommen worden ist. Die pseudodiabetischen vorübergehenden Störungen des Kohlehydratstoffwechsels dürften entweder ein Ring in dem verwickelten Störungsmechanismus der herabgesetzten Resistenz oder einfach direkte Folgen der starken Staphylokokkeninfektion sein.

Die als disponierende Faktoren oft erwähnten oder angenommenen Umstände wie rauhe oder fette Haut, Obstipation oder Diätfehler konnte ich bei meinen Patienten nicht feststellen, sofern man als Diätfehler nicht die durch den Krieg bedingte Beschränkung der Nahrungszufuhr im allgemeinen rechnen will.

Die Verteilung der klinischen Krankheitstypen zwischen Patienten, welche irgendwelche disponierende Faktoren aufweisen (Hauptgruppe A), und solchen, die sonst scheinbar ganz gesund sind (Hauptgruppe B), zeigt, dass die extrafollikulären Staphylo-*dermien*, die multiplen Furunkel und die Karbunkel in der erstgenannten Gruppe verhältnismässig häufiger sind, während wiederum bei den scheinbar gesunden Personen die typische chronisch rezidivierende Furunkulose die herrschende Krankheitsform ist. Nur bei nicht ganz einem Drittel von meinen an chronischen oder chronisch rezidivierenden Staphylokokkeninfektionen leidenden Patienten konnte das Vorhandensein irgendeines bekanntlich disponierenden Faktors nachgewiesen werden, welcher Umstand sehr für das Vorhandensein eines oder mehrerer vorläufig unbe-

kannter, die Empfänglichkeit für Staphylokokkeninfektionen erhöhender Faktoren spricht. Darauf werde ich später eingehender zurückkommen.

Komplikationen.

Als Komplikationen habe ich ausser acht gelassen die bisweilen gleichzeitig mit den Furunkulosen auftretenden, hinsichtlich ihrer klinischen Bedeutung gleichwertigen Hidradenitiden, Lymphangitiden und Lymphadenitiden. Zu den Komplikationen wiederum zählte ich nur die schweren, in den tieferen Körperteilen lokalisierten Krankheiten von der Natur einer Allgemeininfektion. Von diesen Letzteren kamen in meinem Material folgende vor:

Ein Fall von Osteomyelitis des Os occipitale als Komplikation der Nackenfurunkulose, sowie der darauf beruhende, Stasepapillen und heftige, ständige Kopfschmerzen verursachende *epidurale Abszess* (heilte nach Operation).

Zwei Fälle von *Pleuritis exsudativa*, die eine im Zusammenhang mit typischer Furunkulose und die andere mit Stirnkarbunkel, wobei die Letztere auch Symptome von beginnender Thrombose des Sinus cavernosus zeigte. Diese beiden Fälle hatten vorübergehend erhöhte Blutzucker- und Glukosebelastungswerte.

Drei Fälle von langsam fortschreitender, schwerer *Osteomyelitis* des Oberschenkelknochens, von welchen Fällen 2 an septischer Inanition starben und einer nach langer Krankheit, offensichtlich dank der Penicillinbehandlung, heilte. Zwei von ihnen hatten vorher eine typische rezidivierende Furunkulose gehabt, und der dritte vorübergehend im pyämischen Stadium der Osteomyelitis eine pustulöse Staphylodermatitis.

Die Frequenz der schweren Komplikationen (10 %) ist in meinem Material artifiziell zu hoch, weil ich besonders schwere Fälle mitnehmen wollte. Die Pleuritiden, von welchen die eine Penicillintherapie erhielt, zeigten keine Neigung eitrig zu werden und waren auch sonst nicht besonders schwer, weshalb ich geneigt bin, sie als durch Toxinwirkung entstanden zu betrachten. Jedenfalls sprach nichts dafür, dass sie tuberkulös seien.

Wenn auch in dem von TITINEN (1944) gesammelten Osteomyelitismaterial in den zur Verfügung stehenden Krankengeschichten nur bei ca. 10 % vorangegangene eitrige Entzündungen erwähnt waren, so ist es doch mehr als wahrscheinlich, dass solche

Eiterbeulen, die für nicht erwähnenswert erachtet wurden, bei den Patienten viel häufiger vorkamen. Zugunsten meiner Vermutung spricht die Feststellung von FELSETHAL (1934), dass in seinem Material 72 % der Staphylokokkensepsisfälle von Staphylokokkenkrankheiten der Haut ihren Ausgang genommen hatten, davon ca. die Hälfte von Furunkeln. Aus welchen verschiedenen Ursachen und auf welche Weise die Osteomyelitis dann entsteht, ist bis auf weiteres noch nicht geklärt. In das Hinterhauptbein ging sie vermutlich direkt aus den Nackenfurunkeln über. Die Natur der entstandenen Osteomyelitis in meinen drei Oberschenkelknochenfällen war für die Furunkulosen charakteristisch, hinsichtlich ihres Grads nur von schwererer herabgesetzter Resistenz ausgezeichnet. Zwei von diesen primär gut aussehenden Patienten starben nach der langen, durch Schwäche der Abwehrreaktionen charakterisierten Krankheit an kachektischer Inanition, ungeachtet der scheinbar genügend radikalen chirurgischen Therapie. Der dritte Patient seinerseits erholte sich offensichtlich nur dank der Penicillinbehandlung von seiner schweren Krankheit. Der Anstieg des Fiebers und der Anzahl der Leukozyten ging bei diesen Patienten langsam vor sich, nachdem die Schmerzen schon 2—3 Wochen gedauert hatten, und die röntgenologischen Knochenveränderungen sowie die periostale Infiltration mit ihren Abszessen traten erst in der 4.—5. Krankheitswoche in Erscheinung. Die reaktive Entzündung der Operationswunden und die Granulationsbildung waren in ihrer Schwäche gewissermassen ein Beweis für das Fehlen der von BIER (1933) hervorgehobenen »nützlichen Entzündung«. Die von WOLFSOHN (1924) als für Diabetiker charakteristisch beschriebene langsame und schwache Mobilisierung der Abwehrkräfte, zu deren deutlichsten Symptomen verspätete Eiterbildung gehört, tritt ebenso deutlich in Erscheinung sowohl in den Eiterbeulen meiner Furunkulosepatienten als auch bei den komplizierenden Osteomyelitiden. Es lässt sich nicht behaupten, dass die nachweisbare disponierende Faktoren aufweisenden Fälle mehr als die durch reine Infektion bedingten Krankheitsformen Komplikationen allgemeiner Natur hervorriefen, und auch nicht umgekehrt.

Die Bakteriologie.

Die Erregung der Krankheit hängt in der Hauptsache immer ab von zwei Faktoren, nämlich der Resistenz des Patienten und der

Virulenz der ansteckenden Bakterien. Wenn man jedoch die an vorübergehenden Panaritien und Solitärfurunkeln leidenden Patienten hinsichtlich ihrer Resistenz als mittelstark annimmt, so muss man als wesentlich wirkenden Faktor auch die Art der Ansteckung und die Menge der Bakterien in Betracht ziehen. Die direkten Versuche von SCHIMMELBUSCH und GARRÉ zur Erzeugung von Furunkeln in der gesunden Haut durch Einreiben von Staphylokokkenreinkultur in die Follikel zeigen die grosse Bedeutung der Ansteckungsweise bei der Entstehung der Krankheit. Gleichzeitig ging die Bedeutung der ansteckenden Bakterienmenge daraus hervor, dass das Einreiben verdünnter Staphylokokkenbouillon eine oberflächlichere und leichtere Hautinfektion hervorrief. Wegen der an der Haut und den Schleimhäuten fast regelmässig anzutreffenden Staphylokokken, welche ausserdem verhältnismässig oft potentielle Pathogenität zeigen, sind auch viele Forscher geneigt, die Virulenz der Staphylokokken bei den Pyodermien für ganz bedeutungslos zu halten (GEISSE, KLOPSTOCK, KOCH, 1935). Da auch in den Follikeln der gesunden Haut fast ausnahmslos Staphylokokken angetroffen werden, dürfte der Umstand, dass pathogene Kokken dort hineingeraten, in SCHIMMELBUSCHS Versuch nicht allein der wesentlich wirkende Faktor bei der Entstehung der Krankheit sein, sondern dabei wirkt wohl auch die durch das Reibungstrauma hervorgerufene Veränderung in der Reaktionsweise des Hautgebiets zusammen mit der massiven, mit pathogenen Staphylokokken geschehenden Ansteckung. RICHTER betont besonders den die Gewebsvitalität herabsetzenden Einfluss des Diabetes sowie der Stoffwechsel- und innersekretorischen Störungen hervor. Für die Ursache der ständigen Entstehung neuer Furunkel, also für den die Furunkulose aufrechterhaltenden Faktor, hält RICHTER kryptogene Infektionsherde, welche die Reaktionsweise der Haut beeinflussen, indem sie irgendeine Allergie hervorrufen.

Die Eigenschaften der aus den Herden isolierten Staphylokokken.

Ob die aus den Eiterbeulen der Furunkulosepatienten isolierten Staphylokokken sich in den die Pathogenität anzeigenden Versuchen auf die gleiche Weise verhalten wie die Erreger akuter Eiterungen überhaupt, oder ob bei den Furunkulosepatienten wegen der

herabgesetzten Resistenz mehr schwachpathogene Stämme als durchschnittlich nachgewiesen werden können, ist die Frage, auf welche ich in meinem Material zuerst nach Antwort gesucht habe. Die aus den Eiterherden von 60 Patienten isolierten Staphylokokkenstämme zeigten folgende Eigenschaften:

Aureusformen	90 %
Koagulasepositive	91 %
Hämolysepositive	80 %
Mannitpositive	95 %

Von diesen Eigenschaften waren gleichzeitig positiv:

3/3 oder 4/4	76 %
mindestens 2/3 oder 3/4	92 %
» 1/3 oder 2/4 oder 1/4	98 %
0/3 oder 0/4 (alle negativ)	2 %

In der Hauptsache scheinen die Erregerstämme der Infektionen vom Typus der Furunkulose in gleichem Masse pathogene Eigenschaften in vitro aufzuweisen wie auch die Erregerstaphylokokken der akuten Eiterungen. Gewisse Unterschiede sind jedoch festzustellen. So kamen z. B. völlig pathogene Stämme ($\frac{2}{3}$ oder $\frac{3}{4}$ positive Reaktionen) in 76 % vor, entsprechend 60 % bei den akuten Eiterungen. Die sog. herabgesetzte Resistenz wäre also, umgekehrt wie anzunehmen war, durch die grosse Menge ungewöhnlich virulenter Stämme erklärlich. In dieser Hinsicht jedoch bestand ein offenkundiger Unterschied zwischen den Patienten der Hauptgruppen A und B, denn bei den scheinbar sonst gesunden Patienten der B-Gruppe zeigten die Erregerkokken in vitro mindestens $\frac{2}{3}$ oder $\frac{3}{4}$ positive Pathogenitätsreaktionen in 95 % und bei den Patienten der A-Gruppe nur in 84 %, während die nicht-pathogenen oder weniger-pathogenen Stämme verhältnismässig am häufigsten bei den kachektischen und »diabetischen« Patienten der letzteren Gruppe angetroffen wurden, ohne dass die Furunkulose gleichzeitig entsprechend leichter als durchschnittlich gewesen wäre.

Ob die beim gleichen Patienten in den entweder gleichzeitig oder zu verschiedenen Zeiten auftretenden verschiedenen Eiterbeulen anzutreffenden Staphylokokkenstämme untereinander identisch sind, beurteilt auf Grund der zur Verfügung stehenden Untersuchungsverfahren, ist die folgende Frage, deren Lösung ich mir zur Aufgabe gestellt habe. In den 18 Fällen, wo die Staphylokokkenstämme aus mehr als einem Furunkel untersucht wurden, zeigten sie sowohl in den erwähnten Pathogenitätsreaktionen

als auch in den Zuckerserien bei dem gleichen Patienten untereinander immer die gleichen Eigenschaften. Da das Verhalten in den Zuckerserien sowohl bei den klinisch pathogenen als auch bei den Stämmen der Kontrollserien ziemlich oft unregelmässige Schwankung in der Säurebildung der Lactose, Saccharose und Maltose zeigte, lässt sich meines Erachtens mit ziemlicher Wahrscheinlichkeit annehmen, dass die von mir festgestellte Identität der Erreger der verschiedenen Eiterbeulen bei allen Furunkulosen besteht.

Die Quelle der Reinfektion.

Um einen durchgebrochenen, eiternden Furunkel herum entstehen oft neue Furunkel, Eiterpusteln oder ein impetiginöser Ausschlag, wenn die Haut nicht oft gereinigt und mit Salbe vor der Mazeration des Eiters geschützt wird. Bei Personen mit normaler Resistenz sind diese Sekundärherde regelmässig kleiner als der ursprüngliche Furunkel, während sich wiederum bei den Furunkulosepatienten aus einer in der Nachbarschaft entstandenen kleinen Pustel gewöhnlich allmählich ein wirklicher grosser und schmerzhafter Furunkel entwickelt. Bei den ersteren Fällen steigt die Immunität gewissermassen während der Entwicklung der Furunkel, ebenso wie das chronische Acne-Ekzem vorübergehend verschwindet, wenn eine Pustel aus irgendwelchen Gründen zu einem Furunkel angewachsen ist, während dagegen bei den Furunkulosepatienten die die Immunität erhöhende Wirkung der Eiterbeulen vollständig zu fehlen scheint. Das eitriges Sekret des entstandenen Geschwürs ist auch eine offenbare Quelle der Rezidiv-Infektion. In vielen Fällen dagegen ist eine derartige direkte Reinfektion nicht wahrscheinlich, wenn neue Herde weit entfernt von den früheren und besonders nach so langer Zwischenzeit entstehen, dass die vorausgehende Eiterbeule schon lange ganz trocken gewesen ist. Wenn man nicht an die unwahrscheinlich wirkende von aussen her geschehende Reinfektion glauben will, müssen die Staphylokokken in solchen Fällen während der Zwischenzeit irgendwo verborgen gewesen sein.

Beim Pemphigus der Neugeborenen ist die Infektionsquelle gewöhnlich in der Nase des Pflegepersonals zu suchen (SPARREVOHN, 1944, ANDERSEN, 1944). Von dort liess sich der gleiche, serologisch identifizierte Staphylokokkenstamm züchten wie aus den Pemphiguspusteln. Man könnte sich wie DANBOLT denken,

dass die Furunkulosepatienten als Ausgangspunkt der Reinfektion im eigenen Körper einige Staphylokokkenherde hätten. Die Annahme, dass die Virulenz der saprophytischen Staphylokokkenstämme zunähme, so dass sie die Quelle der Reinfektion wären, ist nicht wahrscheinlich, weil sich der vom gleichen Patienten nach einer Zwischenzeit von mehreren Monaten aus den Furunkeln isolierte Stamm in den Versuchen ausnahmslos mit dem früher untersuchten Stamm als völlig identisch erwies, während die Eigenschaften der Staphylokokken, namentlich das Verhalten in der Zuckerserie, sonst beträchtliche Schwankungen zwischen den verschiedenen Stämmen aufweisen.

Zur Auffindung der möglicherweise als Ausgangspunkt der Reinfektion tätigen Herde habe ich bei meinen 60 Patienten auf der gesunden Haut, in der Nase und im Rachen nach den gleichen Staphylokokkenstämmen gesucht, die im Eitersekret der Eiterbeule angetroffen worden waren. Stämme, die sich mit den angewandten Untersuchungsmethoden — also mit den Pathogenitäts- und Zuckerreaktionen — mit den im Furunkelleiter angetroffenen Staphylokokken als identisch erweisen, wurden angetroffen wie folgt:

In den aus der Nase entnommenen Proben	33 Fälle von 60	55 %
In den aus dem Rachen entnommenen Proben	9 » » 60	15 %
In den von der gesunden Haut entnommenen Proben	19 » » 60	31 %

Indem man die bei gesunden Personen und die bei Furunkulosepatienten aus der Nase und von der Haut isolierten Staphylokokkenstämme miteinander vergleicht, kann man feststellen, dass bei meinen Patienten deutlich mehr pathogene Stämme an diesen Stellen vorkommen.

Tabelle 3.

	Haut		Nase	
	Gesunde	Fur. Patient.	Gesunde	Fur. Patient.
Stämme, bei welchen mindestens $\frac{2}{3}$ oder $\frac{3}{4}$ der Path. Reaktionen positiv waren (% von der Anzahl der untersuchten Fälle)	15 %	36 %	29 %	50 %
Stämme, wo $\frac{2}{4}$, $\frac{1}{3}$, $\frac{1}{4}$ oder 0 der Reaktionen positiv waren	51 %	34 %	35 %	22 %

Während auf der Haut und in der Nase von gesunden Personen pathogene Staphylokokken (d. h. solche, die mindestens $\frac{2}{3}$ oder $\frac{3}{4}$ positive Reaktionen ergeben) verhältnismässig selten vorkommen (15 und 29 %), sind die Patienten mit herabgesetzter Resistenz relativ viel häufiger Träger von pathogenen Staphylokokken an den entsprechenden Stellen (36 und 50 %). Der Unterschied wird beträchtlich dadurch erhöht, dass sich bei den Furunkulosepatienten die Stämme der Haut und der Nase meistens als identisch erwiesen mit den Stämmen, welche die Eiterbeulen hervorriefen. Die Patienten sind also gewissermassen durch und durch mit den in Frage stehenden Staphylokokkenstämmen verseucht, so dass Ausgangspunkte für die Reinfektion, auch wenn man die direkte aus den Beulen-Sekreten geschehende Infektion ausser acht lässt, in Überfülle vorhanden sind.

Die Bedeutung der Ansteckungsweise bei der Entstehung der Furunkel.

Wegen der Fülle der Reinfektionsquellen bei den Furunkulosepatienten muss auf die Entstehung einer neuen Eiterbeule auch die Ansteckungsweise wesentlich einwirken. Die häufigste Lokalisierung der Furunkel sowohl in Einzelfällen als auch bei den Furunkulosepatienten auf solche Stellen der Haut, die ständig einer Reibung z. B. durch die Kleider oder dergl. ausgesetzt sind, spricht zugunsten des Vorhandenseins eines disponierenden Faktors im Sinne von SCHIMMELBUSCHS Versuch. Damit also ein Furunkel bei einer gesunden Person entsteht, ist erforderlich, dass sie zufällig pathogene Staphylokokken an der Körperoberfläche hat, und dass diese unter dem Einfluss eines mechanischen äusserlichen Faktors in grosser Anzahl in die Follikel eindringen können. Bei den Furunkulosepatienten dagegen dürfte das Einreiben der Bakterien in die Follikel, wenn es auch die Lokalisation der neuen Herde bestimmen kann, kein so ausschlaggebender Faktor sein wegen der Fülle des Reinfektionsstoffes und der schwachen Immunität. Der letztgenannte Faktor dürfte am ehesten den Umstand bedingen, dass sich bei den Furunkulosepatienten alle Herde zu Eiterbeulen voller Grösse entwickeln, wobei harmlosere, leichtere und vorübergehende Formen von Hautinfektion geradezu selten sind.

Welche Aufschlüsse geben die klinischen und bakteriologischen Feststellungen der Untersuchung über die sog. herabgesetzte Resistenz?

Unsere Kenntnisse über das Wesen der herabgesetzten Resistenz als Gesamtheit sind spärlich. Die wirklichen Ursachen der verminderten Widerstandsfähigkeit gegen Infektionen bei Kachexie und verschiedenen lokalen Nutritionstörungen sowie den Einfluss der Vitaminmangelzustände können wir kaum anders als hypothetisch klären. Etwas weiter, wenn auch nicht bis zum Ziel, ist man bei der Klärung der Ursachen für die herabgesetzte Resistenz bei den Diabetikern gekommen, und gerade durch die Untersuchungen der gewöhnlichen Staphylokokkeninfektionen bei den Diabetikern. In den Versuchen von WOLFSOHN (1924), bei welchen Normalserum und Staphylokokken zusammen mit Blutzellen eines Diabetikers gebraucht wurden, war die Herabsetzung des opsonischen Index' regelmässig so deutlich, dass WOLFSOHN der Ansicht ist, bindend bewiesen zu haben, dass die herabgesetzte Resistenz der Diabetiker auf die Schwäche und langsame Mobilisation der phagozytierenden Abwehrkräfte, vor allem der Leukozyten zurückzuführen sei. Die von RICHTER bei Karbunkelpatienten und von mir in 3 Fällen festgestellte vorübergehende Glukosurie und -ämie können natürlich empfindliche Symptome der diabetischen Disposition sein, jedenfalls sprechen sie für die nahe Beziehung solcher Krankheiten zu den Störungen des Kohlehydratstoffwechsels. Hierbei ist jedoch nicht geklärt, was von beiden, die Infektion oder die Stoffwechselstörung, die Ursache ist und was die Folge.

Aus den Beobachtungen in meinem Material geht hervor, dass die langsame und schwache Reaktionsweise oder natürliche Immunität nicht allein für die Diabetiker charakteristisch ist. Bei meinen scheinbar ganz gesunden nicht-diabetischen Patienten »reiften« die Furunkel langsam, während gleichzeitig der Umfang der Nekrose und die schwache Entzündungsreaktion der Umgebung gewissermassen zueinander im Missverhältnis standen im Vergleich zu den vorübergehenden Furunkeln einer Normalperson. Die gleiche Reaktionsschwäche zeigte die Osteomyelitis, wenn sie derartige Fälle komplizierte. Bei einem Teil meiner Fälle war diese Schwäche der Resistenz oder Immunität indessen gewissermassen mehr allgemeiner Art, so dass ihre Ur-

sachen sozusagen mit gröberen Behandlungsmethoden zu eliminieren sein schienen. In der Mehrzahl der Fälle, namentlich unter den »typischen rezidivierenden Furunkulosen«, konnte dagegen nicht das geringste Zeichen von einer Steigerung der Immunität während der Behandlung wahrgenommen werden. Diese verschiedenartige Reaktionsweise kann man nicht mit Pathogenität der Erregerkokken oder Verschiedenheit der Reinfektionsmöglichkeiten erklären. Ex analogia lässt sich nur vermuten, dass wie beim Diabetes und dem post-thrombotischen Zustand auch in den »idiopathischen« Fällen bis auf weiteres unbekannte Störungen des Stoffwechsels als eine Herabsetzung der natürlichen Gewebsimmunität zum Ausdruck kommen.

Die von der Untersuchung gebotenen therapeutischen Gesichtspunkte.

Ich berühre kurz die vielumstrittene Frage, ob die Solitär-furunkel geöffnet werden sollen, und wie die Eröffnung auszuführen ist, indem ich feststelle, dass die alte chirurgische Regel »ubi pus ibi evacua« auch bezüglich jedes Furunkels sofort zutrifft, wenn darin auch bei Ruhe fühlbarer, pochender Schmerz auftritt. Desgleichen ist ein Karbunkel immer mit radikaler Excision zu behandeln, auf deren Details in diesem Zusammenhang nicht näher eingegangen zu werden braucht. Nur auf die Operationssicherheit, welche die Diathermieklinge und die kombinierte Chemo-Heparinbehandlung auch im Gesicht bietet, sei hingewiesen.

Die Massnahmen, mit welchen man versucht hat, die chronisch rezidivierende Staphylokokkeninfektion abzubrechen, sind fast unzählbar, was den Mangel an einer für alle Fälle geeigneten, anerkannten Methode der Wahl beweist. Umfangreichere persönliche Erfahrung habe ich nur über den Gebrauch des polyvalenten Staphylokokkenvakzins, mit welchem ich in Ermangelung besserer Mittel verhältnismässig zufrieden gewesen bin. Meistens, genauer gesagt in ca. 50—60 % meiner Fälle aus mehreren Jahren, hörte das Erscheinen neuer Furunkel nach 3—4 in steigenden Dosen sub- oder intra-kutan verabreichten Injektionen auf. Indem gleichzeitig für die vom Diabetes erfordernten speziellen und von der Kachexie erfordernten allgemeinen therapeutischen Massnahmen sowie für die sehr oft vernachlässigte Reinlichkeit Sorge getragen wurde, habe ich recht zufriedenstellende

Resultate erzielt in denjenigen Fällen, wo die Infektionsdisposition mehr allgemein als spezifisch wirkte. In derartigen Fällen ist die Hebung des immunbiologischen Zustandes offensichtlich auf sehr viele verschiedene Weise möglich. Die Wirkung der polyvalenten und sogar auch der Auto-Staphylokokkenvakzine ist von vielen autoritativen Seiten als unspezifisch bezeichnet worden (THOMSEN, 1932). Negativ haben sich zur Vakzinbehandlung oft die erwähnten »typischen« Furunkulosen bei scheinbar gesunden Personen verhalten. Das Gelingen auch bei einem Teil der Fälle aus dieser Gruppe ermutigt jedoch dazu, sie wegen ihrer völligen Gefährlosigkeit anzuwenden, da ich von den anderen, von mir weniger probierten Mitteln, der Sulfatiazolmedikation, den Eigenblutinjektionen usw. keine sichere Wirkung beobachtet habe.

Die Therapie, da sie also bis auf weiteres nur selten bei typischen Furunkulosen auf immunbiologischem Wege wirkt, ist deshalb auf eine gleichzeitige Bekämpfung der Reinfektion mit Mitteln der Anti- und Asepsis zu richten. Aus meinen bakteriologischen Feststellungen geht hervor, dass ausser bei gesunden Personen besonders bei den Furunkulosepatienten potential pathogene Staphylokokken auf der Haut und den Schleimhäuten reichlich vorhanden sind. Wenn es möglich wäre, diese zu vermindern, so würden dadurch die Möglichkeiten der Reinfektion geringer. In diesem Sinne halte ich die von vielen Autoren abgelehnten Bäder (RICHTER) für äusserst empfehlenswert. Die von PRICE (1944) mitgeteilten guten Resultate der während der Furunkelintervalle gegebenen gründlichen Alkoholwaschungen (Massage der Haut des ganzen Körpers täglich 20 Minuten lang mit 70 % Alkohol) sprechen sehr zugunsten meiner Ansicht. Wenn man mit den chemo- oder biotherapeutischen Stoffen der Gegenwart und Zukunft imstande wäre, auch nur teilweise wenigstens vorübergehend die Flora der pathogenen Staphylokokken auf der Haut und den Schleimhäuten zu vernichten, wird die Frage der Therapie für die grosse Mehrzahl der Patienten offenbar auf diesem Wege befriedigend gelöst.

Zusammenfassung.

Der Verfasser hat versucht, durch bakteriologisch-klinische Untersuchungen den Infektionsmechanismus in 60 Fällen von chronisch rezidivierenden Staphylodermien zu klären. Die Pig-

mentbildung (Aureusform), die Bildung von Hämolsin und Plasmakoagulase sowie die Fähigkeit, Mannit zu zersetzen, haben als Zeichen der potentialen Pathogenität die Differenzierungsgrundlage gebildet, wonach von den auf der Haut gesunder Personen angetroffenen Stämmen 21 %, von den in der Nase angetroffenen 46 % und von den in Eiterproben angetroffenen 93 % sich *in vitro* als pathogen erwiesen. Auf Apathogenität hinweisende Eigenschaften zeigten in den entsprechenden Proben 57, 41 und 4 % der isolierten Stämme. Die Beurteilung der Pathogenität *in vitro* ist demnach immer in gewissem Masse relativ.

Das klinische Material betrifft in 60 % der Fälle »typische« rezidivierende Furunkulose, meistens bei scheinbar gesunden Personen. Dagegen ist die sog. herabgesetzte Resistenz, die sich in Chronizität und mangelnder Heilungstendenz kennzeichnet, bei den Fällen (zusammen 40 %) mit zahlreichen gleichzeitigen Furunkeln, Karbunkeln und extrafollikulären Staphylodermien verhältnismässig oft durch disponierende Faktoren mehr oder minder erklärbar (Diabetes, Pseudodiabetes, Kachexie oder lokale Ursachen).

Bei den langwierigen Staphylokokkenkrankheiten schienen die aus den Krankheitsherden isolierten Staphylokokken bei den Versuchen *in vitro* im gleichen Masse oder auch durchschnittlich etwas mehr pathogen zu sein als die Erreger der akuten Eiterungen (Panaritien etc.). Bei einem und demselben Furunkulosepatienten wurden in den verschiedenen Eiterbeulen und zu verschiedenen Zeiten ausnahmslos identische Stämme angetroffen.

Die möglichen Ausgangspunkte für die Reinfektion sind die Haut und die Schleimhäute, da in der Nase und auf der gesunden Haut der Patienten in ca. 50 % die gleichen Stämme gefunden wurden wie in den Eiterbeulen. Bei den Fällen mit aus erklärlichen Ursachen herabgesetzter Resistenz kamen als Erreger verhältnismässig häufiger Stämme vor, die *in vitro* eine geringere Pathogenität als sonst zeigten.

In der Furunkulosetherapie ist nach Ansicht des Verfassers die Verminderung der Reinfektionsmöglichkeiten mit Mitteln der Anti- und Aseptik sowie mit Hilfe der Chemotherapie neben der unsicheren Vakzinebehandlung am wichtigsten.

Summary.

The author has endeavoured, by means of clinical-bacteriological investigations, to elucidate the infection mechanism in 60 cases of relapsing staphylodermia. As a differentiating basis the formation of pigment, hemolysin and plasma coagulase together with the capacity of demolishing mannite has been accepted as being signs of potential pathogenesis. On the basis of this, 21 % of the strains in the skin of healthy persons, 46 % of those in the noses of healthy persons, and 93 % of the strains discovered in pus samples in vitro, have proved to be pathogenic. Qualities pointing to apathogenesis were shown in 57 %, 41 % and 4 % respectively of the isolated colonies. The opinion regarding pathogenesis in vitro is therefore always relative to a certain extent.

The clinical material comprises, in 60 % of the cases, typical relapsing furunculosis, more often in apparently healthy persons. On the other hand, the so called reduced resistance characterized by chronicity and defective healing tendency in the cases (40 % in all) of numerous coincidental furuncles, carbuncles and extra-follicular staphylodermia is fairly often more or less explainable by predisposing factors (diabetes, pseudo-diabetes, cachexia or local causes).

In staphylococcus diseases of long standing, the isolated staphylococci obtained, in tests in vitro, from the seat of disease appear to possess similar or, on an average, somewhat higher pathogenesis than the originators of the acute purulent inflammations (panaritium etc.). In one and the same furuncular patient identical species were discovered in the different furuncles at different times.

The possible sources of reinfection are the skin and mucous membrane, although in the noses and healthy skins of about 50 % of the patients the same species which existed in the furuncles were discovered. In cases with explainable reasons for diminished resistance, there appeared relatively frequently strains as causes which, in vitro, showed comparatively little pathogenesis.

With regard to the therapy the author considers that a lessening of the possibilities for reinfection by the use of antiseptic and aseptic means as well as of chemotherapy, together with the uncertain vaccine treatment, is the most important.

Résumé.

Par des recherches clinico-bactériologiques l'auteur a essayé d'éclaircir le mécanisme de l'infection dans 60 cas de staphylo-dermites récidivantes. La production de pigment, d'hémolysine et de coagulase plasmatique, ainsi que le pouvoir de dissocier la mannite, ont été considérés comme signant le caractère pathogène potentiel et pris pour bases sur quoi établir la différenciation. Avec ce point de départ 21 % des souches provenant de la peau de sujets sains, 46 % de celles du nez de personnes en santé, et 93 % des prélèvements de pus se sont montrées pathogènes in vitro. Les qualités parlant pour l'absence de caractère pathogène ont été observées respectivement dans 57, 41 et 4 % des souches qui furent isolées. Ainsi l'appréciation de la valeur pathogène in vitro reste toujours relative dans une certaine mesure.

Le matériel clinique est formé, dans 60 % des cas, de furonculoses récidivantes typiques, la plupart chez des personnes tout à fait saines en apparence. Par contre le défaut de résistance organique, se donnant à connaître par la chronicité et le manque de tendance à la guérison, dans les cas présentant de nombreux furoncles simultanés, des carbuncles et des staphylo-dermites extra-folliculaires (en tout 40 % du matériel) est plus ou moins explicable, bien que de façon relative, par des facteurs prédisposants (diabète, pseudo-diabète, cachexie ou causes locales).

Les microbes isolés des foyers pathologiques dans les maladies staphylococciques de longue durée semblent, in vitro, posséder un caractère pathogène égal, ou en moyenne un peu supérieur à celui des agents des inflammations suppurantes aiguës (panaris, etc.). Chez un même sujet atteint de furunculose on a trouvé des souches identiques, à l'exclusion de toute autre, dans les divers abcès et lors d'examens à différentes époques.

Les points de départ des réinfections sont la peau et les muqueuses, puisque dans le nez et sur le tégument normal des malades on a trouvé dans environ 50 % des cas les mêmes souches que dans les foyers suppurés. Là où existaient des causes expliquant la diminution de la résistance, les agents microbiens sont assez souvent des souches qui in vitro ont révélé des aptitudes pathogènes relativement faibles.

En ce qui concerne le traitement de la furunculose, l'auteur estime que la réduction des possibilités de réinfection par des

moyens anti- et aseptiques, et la chimiothérapie, à côté de l'incertaine vaccinothérapie, est ce qui importe le plus.

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Postoperative Blood Changes with Regard to Shock.

By

SVANTE ANNERSTEN and EGON NORINDER.

I. Introductory Remarks.

In seeking to follow up and evaluate postoperative shock conditions it is of major importance to single out the phenomena referable to shock, which are elicited by the surgical intervention per se.

Since the patho-physiology and clinical picture of shock have been exhaustively described in several monographs of recent date (*e. g.* HARKINS, 1941, MOON, 1942, KØSTER, 1943), those facts will not be recapitulated.

The *amount of circulating blood* subsequent to a surgical intervention is of great significance in the syndrome of shock. EPPINGER found that the amount of blood circulating in the large vessels in postoperative shock is diminished. In a great number of cases EWIG and KLOTZ (1932) determined the amount of circulating blood subsequent to a surgical intervention partly by the Co-method, and partly by using the Congo red staining method supplemented by hemocrit readings. In the majority of the cases they found an *increase in the amount of blood* which they considered to be due to depletion from the spleen. After 2—3 days the value of the blood volume was again normal. In cases of this type the blood pressure was normal or slightly increased. Otherwise, the postoperative course was uneventful. EWIG and KLOTZ termed this type of reaction "compensated postoperative shock". In some cases a decrease in the amount of the circulating blood occurred associated with a decline in the blood pressure, giving rise to clinical symptoms of shock. Cases of this type were referred to as cases of "de-compensated postoperative shock".

GIBSON and BRANCH (1937) used EVAN's blue-dye method and proved that in normal cases the diminution of plasma was greater than the loss of blood corpuscles subsequent to surgical interventions. This led to the interpretation that the surgical intervention per se evoked a certain susceptibility for shock. LAMBRET and DRIESSENS (1937) likewise used the Congo red staining method and obtained similar results in cases in which the surgical intervention was particularly traumatizing. 2—5 hours after the operation, however, the blood volume was again normal. The results obtained by WINDFELDT are, to a certain extent, inconsistent with these data. This author claimed, that a decrease in the hematocrit value and plasma protein occurred, a condition which, as is known, should not be interpreted as symptom of shock. In WINDFELDT's cases, however, the minimum values were determined as late as from the 5th day onwards to the 17th day subsequent to the surgical intervention and therefore they should be interpreted as being due to haemorrhagic action rather. Even HEUK's (1925) and HEUSSER's (1928) investigations revealed a post-operative decrease in the plasma protein.

As may be seen the available data on the volume of circulating blood subsequent to surgical interventions are rather conflicting. This is most likely due to methodical variations. It may, however, be assumed that there is, to a certain extent at least, a susceptibility to shock present immediately after a surgical intervention, but it seldom leads to symptoms of such severe character that hemoconcentration arises. The majority of the surgical interventions reported were performed under general narcosis. In this connection SCHUBERT's studies on spinal anaesthesia are particularly interesting. This author claimed that spinal anaesthesia per se does not cause a decrease in the amount of circulating blood.

The behaviour of the blood pressure after surgical interventions calls for special attention. As a rule, there is an increase persisting for a couple of days, a fact which has been confirmed by EWIG and KLOTZ, BERG and SEMB (1933) et al. In BERG and SEMB's material the blood pressure was increased in 60 per cent of the cases, in 34 per cent the value was unaltered, and in only 6 per cent of the cases the blood pressure was decreased. These findings are consistent with the assumption, that in postoperative shock there is a preliminary phase accompanied by vasoconstriction. Postoperative hyperglycemia supports this view. This condition is an as good as constantly exhibited symptom and has been demonstrated by many workers (*e. g.* DALE 1933, ROSCHER, 1933, LAMBRET and DRIESSENS, 1937, HABELMANN, 1941). Numerous views have been advanced in medical literature on this type of hyperglycemia. The possibility is conceivable that it is due to several interacting causative agents. It has been put in relation to acidosis which was supposed to contribute in reducing the capacity of the liver to form glycogen. The general trend of opinion, however, seems to be, that this

type of hyperglycemia is due to stimulation of the sympatho-adrenal system. If this were true it would mean the disclosure of a definitely early symptom of the symptom complex of shock indicating, that the surgical intervention per se is a shock producing factor. Hyperglycemia may be readily followed up, and it should be interpreted as an early alarm signal of shock calling for prophylactic measures (ANNERSTEN).

The occurrence of postoperative acidosis has been demonstrated by a number of investigators (*e. g.* GRAMÉN, WYMER, BJURE, ROSCHER, LAMBRET, and DRIESSENS). Generally, evidence of depletion of the alkali reserve led to the recognition of the presence of acidosis. The depletion was, as a rule, inconsiderable, and usually it was compensated at the end of 6—24 hours. After local or spinal anaesthesia it was less marked or not at all pronounced. Ketonuria was, as a rule, present after surgical interventions performed under general narcosis whereas after operations under local or spinal anaesthesia it occurred very rarely only. A careful examination of ROSCHER's material furnished evidence that individuals operated on under local and spinal anaesthesia manifested lesser damage of the tissues than those operated on under general narcosis. Neither GRAMÉN nor WYMER found ketonuria to be present solely after ether narcosis. It therefore appears doubtful whether narcosis per se accounts for the postoperative acidosis. As regards the latter, the condition of hunger acidosis has also to be taken into account. As a rule, however, it does not manifest itself before a couple of days have elapsed.

Lactic acid, and, to a certain extent even keto-acids are responsible for postoperative acidosis (KIRK). Increase in rest nitrogen presupposes even increase in acid protein breakdown products. Acidosis to which major importance is attributed in the literature on postoperative conditions, does not play any genetic rôle in shock. Since postoperative acidosis occurs at an early stage it can merely be considered as *a contributory factor in the possibly shock-producing effect of the surgical intervention*. Acidosis may even be due to the existence of a primary disease (peritonitis, ileus, bilious and intestinal fistule and so forth). Acidosis, though being a factor of considerable clinical importance (*cf.* BOHMANSSON *et al.*) is only a secondary phenomenon in the mechanism of shock. Most likely more powerful reactions of the tissues have a bearing upon this mechanism.

Among other blood changes which may be caused by both shock and surgical intervention the following ones should be mentioned: 1) the decrease in the amount of plasma chlorides (LAMBRET and DRIESSENS, SEMB and BERG), 2) the increase in the amount of sulfate (STAHL, BOURNE and BARBOUR), and 3) the increase in the values of plasma potassium (SCUDDER, *et al.*). STEWART and

ROURKE (1938) observed a decrease in the value of serum potassium in man after surgical interventions. In none of these patients did the loss of blood exceed 13 per cent of the normal blood volume. According to LUCERNA, PEREGRINO, RAMOS and BETHLEN (1940), the K-value of the plasma increases and its Na-value decreases subsequent to surgical interventions.

A slight increase in the rest nitrogen as well as acceleration of the sedimentation rate are postoperative phenomena which occur almost constantly (LAMBRET and DRIESSENS, FREY et al.). The latter has, among other things, even been put in relation with a relative increase in globulin. The results obtained by FREY (1944), however, seem to suggest that the albumin-globulin ratio is maintained fairly constant prior and posterior to a surgical intervention. WINDFELDT found that the amount of proteins was diminished posterior to surgical interventions, particularly that of the finely dispersed ones.

II. The Problems discussed in the Present Paper and the Pertinent Investigations.

A. Working-Scheme.

The present authors based their reasoning on the recognition, that the postoperative alterations were intimately linked with the condition of shock. In all probability, extensive surgical interventions evoke a susceptibility to shock. Intimate collaboration between clinical departments and laboratories will, therefore, not only be helpful towards segregating the earliest contributory factors of shock, but it will even be — to a certain extent at least — a valuable aid in elucidating the etiological factors.

Anoxemia is a central factor in the mechanism of shock. It is caused by a decrease in the volume of the circulating blood which in its turn is due to the loss of fluid within the blood vessels. Thus the problem of the behaviour of the blood pressure, plasma-leakage and capillary permeability imposes itself. The significance of these factors may be evaluated by numerous methods of investigation. No doubt, they are related to hormonal action, changes in the plasma constituents, ionic concentration, the acid-base ratio, and so forth, inasmuch as they seem to have a reciprocal bearing on one another in such a manner that one factor is the causative agent and the other the effect, and frequently forming a vicious circle the mechanism of which is not yet understood.

The scheme elaborated for the present studies is based on the following principles:

a) Testing of the various methods of analysing blood to ascertain their suitability for clinical use in diagnosing shock.

b) Investigating the frequency of shock and the occurrence of shock symptoms in the common variety of surgical cases.

c) Evaluating the results obtained by the analyses, firstly with the view of revealing not only manifest but also latent complications which might possibly lead to shock, and secondly for the purpose of applying the necessary restorative measures as early as possible.

A survey of the pertinent literature revealed that the data published up to date were far from being exhaustive or definite. Many workers based their results or theories on incomplete material. On the other hand, the investigations of numerous workers on the essential problems in the mechanism of shock yielded divergent and even conflicting results. Considering these circumstances we assumed that the present study would even be of some propaedeutic significance.

283 cases were examined giving special consideration to the various views existing on the condition of shock. It should, however, be emphasized, that these cases were not judiciously chosen. The patients were examined one after the other as they came from the operation. Preference was, to a certain extent, given to cases on which an extensive surgical intervention had been performed. The results of the analyses made on the patients prior to the operation were used for purposes of comparison. In this connection it should be emphasized, that every individual who was examined, had been the subject of a primary disease which had called for surgical intervention.

The blood samples were withdrawn from a cubital vein during stasis of brief duration. To obtain serum they were immediately centrifuged. To provide a sufficiently large number of samples for spectral analyses the cation analyses were extended over several days; all other analyses were made during the course of 24 hours.

The routine clinical examinations of the patients were supplemented by a number of special analyses which were made both prior to the operation and at different intervals after the surgical intervention. These comprised the following determinations which we considered to be of major importance in diagnosing shock.

Blood pressure records.

Hematocrit readings (van Allen).

Determination of the total content of protein serum (Teorell's hypobromite method, and the falling-drop method).

Determination of the total base content of the serum (Nielsen's method).

Determination of the cation content of the serum (Lundegårdh's low spectrum methods).

Determination of the potassium content of the serum (the spectral colorimetric method after Lundegårdh and Boratinsky).

Determination of the CO_2 content of the serum (van Slyke's manometric method).

Determination of the chloride content of the serum (electrometric titration).

Determination of the blood sugar content of the serum (Hagedorn).

Determination of the lactic acid content of the serum (Avery-Hasting's method).

The examinations were made prior and subsequent to the following surgical interventions: gastric, gall-bladder, struma, thoracoplastic, renal operations, laparotomies, plastic operations on the mamma, amputations of the mamma and minor operations (see Table I p. 326—327). The operations were made under general narcosis (chlorethyl, ether, narcotal), spinal anaesthesia as well as under local anaesthesia.

B. Methods.

a) *Determination of Serum Protein by the Falling Drop Method.*

The Hypobromite method elaborated by TEORELL was used as standard and control method for the analytical work. It is a strict micro-method based on wet combustion of the material and on titrating the N-content of the sample by the alkali hypobromite. For routine clinical determinations of the serum protein this method proved to be less suitable. It is not only time-consuming — one single analysis takes about 6 hours — but it requires even a wide experience in analytical procedures. We found this method to be subjected to an error of ± 1 per cent.

In the later course of the present investigation we determined to test the physical methods of determining protein. MOORE & VAN SLYKE demonstrated that there exists a constant relation between the serum protein content and the specific gravity. BING elaborated a method of determining the protein content which is directly based on his findings regarding the specific gravity and the protein content. This method is now widely used. In 1926 BARBOUR & HAMILTON described a method of determining the specific gravity in which the latter is determined by a drop of fluid thrown down in a specific solution.

When we determined the serum protein by physical methods we proceeded in the main according to the principles advanced by KAGAN. A glass receptacle containing water of 20° temperature was fitted with

Table I.

	Values before operation	Values immediately after operat.	Values one day after operat.	Values two days after operat.	Values three days after operat.
<i>Gastric Operations</i>	17 cases	3 cases	13 cases	3 cases	5 cases
Serum CO ₂	29.59 ± 0.86	29.88 ± 2.27	27.16 ± 0.92	27.60 ± 1.97	29.81 ± 0.69
Serum Cl	111.8 ± 3.0	120.6 ± 5.1	107.8 ± 2.6	131.8 ± 8.3	105.4 ± 3.9
Total base	145 ± 1.9	130 ± 2.6	143 ± 2.8	148 ± 3.4	146 ± 1.0
Serum protein	7.26 ± 0.11	6.93 ± 0.08	7.16 ± 0.17	6.76 ± 0.41	6.95 ± 0.26
Serum potassium	18.9 ± 0.63	17.7 ± 0.29	19.3 ± 0.88	18.2 ± 1.26	17.1 ± 0.52
Serum lactic acid	2.44 ± 0.31	3.86 ± 0.26	4.18 ± 0.22	3.22 ± 0.55	2.60 ± 0.23
Haematocrit	42 ± 0.8	37 ± 0.8	44 ± 1.0	41 ± 1.0	37 ± 0.8
Blood sugar	87 ± 3.5	166 ± 4.3	157 ± 14.5	147 ± 19.5	90 ± 4.7
<i>Operations on the Gall-bladder</i>	17 cases		11 cases	5 cases	10 cases
Serum CO ₂	31.02 ± 0.96		27.84 ± 0.87	31.08 ± 0.56	30.59 ± 1.22
Serum Cl	105.8 ± 3.6		101.6 ± 2.1	100.7 ± 2.6	96.5 ± 2.0
Total base	150 ± 1.0		148 ± 2.3	149 ± 1.6	149 ± 1.2
Serum protein	7.56 ± 0.16		7.76 ± 0.20	7.02 ± 0.11	6.83 ± 0.20
Serum potassium	20.9 ± 1.08		19.9 ± 0.73	19.9 ± 2.67	19.6 ± 1.13
Serum lactic acid	2.85 ± 0.38		4.07 ± 0.59	2.04 ± 0.11	—
Haematocrit	43 ± 1.1		47 ± 4.3	39 ± 2.7	40 ± 1.8
Blood sugar	106 ± 8.3		153 ± 9.0	115 ± 10.5	116 ± 11.0
<i>Struma Operations</i>	12 cases		8 cases	7 cases	5 cases
Serum CO ₂	30.45 ± 0.49		29.36 ± 0.43	30.78 ± 0.73	29.89 ± 0.81
Serum Cl	100.7 ± 1.5		96.8 ± 3.5	98.5 ± 1.7	100.9 ± 2.5
Total base	151 ± 1.4		147 ± 2.2	147 ± 0.9	152 ± 1.7
Serum protein	6.92 ± 0.17		7.02 ± 0.19	7.30 ± 0.32	7.56 ± 0.18
Serum potassium	20.3 ± 0.61		20.0 ± 0.75	20.0 ± 0.58	19.5 ± 0.34
Serum lactic acid	1.86 ± 0.31		2.41 ± 0.38	3.57 ± 0.40	198 ± 0.24
Haematocrit	44 ± 0.8		42 ± 0.7	42 ± 1.5	36 ± 0.9
Blood sugar	105 ± 4.3		130 ± 14.5	116 ± 20.3	108 ± 3.7
<i>Thoracoplastic Operations</i>	7 cases		7 cases	3 cases	5 cases
Serum CO ₂	29.16 ± 0.78		28.13 ± 0.93	29.94 ± 1.33	29.07 ± 0.53
Serum Cl	101.3 ± 1.9		99.3 ± 2.0	86.1 ± 0.3	96.6 ± 0.7
Total base	146 ± 1.6		148 ± 0.8	146 ± 1.2	142 ± 1.4
Serum protein	8.08 ± 0.18		7.61 ± 0.18	7.75 ± 0.18	7.78 ± 0.19
Serum potassium	19.4 ± 1.04		20.4 ± 0.50	20.2 ± 0.62	20.0 ± 0.69
Serum lactic acid	2.16 ± 0.27		4.11 ± 0.33	2.47 ± 0.20	2.48 ± 0.27
Haematocrit	35 ± 1.7		35 ± 1.8	33 ± 1.7	30 ± 1.5
Blood sugar	91 ± 4.5		148 ± 7.6	122 ± 4.6	116 ± 7.8
<i>Plastic Operations on Mamma</i>	4 cases		4 cases	2 cases	2 cases
Serum CO ₂	28.35 ± 0.59		27.99 ± 1.00	28.71 ± 0.08	30.87 ± 0.97
Serum Cl	108.4 ± 3.4		113.2 ± 7.3	114.6 ± 9.4	102.2 ± 0.6
Total base	142 ± 4.2		141 ± 3.6	137 ± 8.9	156 ± 4.8
Serum protein	7.49 ± 0.19		7.28 ± 0.33	7.00 ± 0.36	7.55 ± 0.11

	Values before operation	Values immediately after operat.	Values one day after operat.	Values two days after operat.	Values three days after operat.
Serum potassium . . .	20.6 ± 0		22.6 ± 1.6	18.0 ± 1.1	18.1 ± 0
Serum lactic acid . . .	1.30 ± 0.27		2.87 ± 0.39	1.63 ± 0.37	1.34 ± 0.13
Haematocrit	29 ± 0		38 ± 1.4	41 ± 0	44 ± 3.2
Blood sugar	103 ± 20.4		109 ± 5.3	119 ± 2.9	108 ± 1.6
<i>Radical Operations on Mamma</i>	3 cases		3 cases	2 cases	
Serum CO ₂	28.68 ± 0.12		28.32 ± 0.94	31.31 ± 1.02	
Serum Cl	102.7 ± 1.2		102.1 ± 3.5	102.3 ± 3.7	
Total base	148 ± 4.5		147 ± 1.5	149 ± 2.1	
Serum protein	7.45 ± 0.05		7.15 ± 0.23	7.23 ± 0.34	
Serum potassium . . .	19.6 ± 2.54		18.7 ± 0.17	20.1 ± 0.47	
Serum lactic acid . . .	1.75 ± 0.70		2.42 ± 0.34	2.75 ± 0.14	
Haematocrit acid . . .	46 ± 0		38 ± 1.8	35 ± 0	
Blood sugar	135 ± 0		94 ± 9.7	104 ± 1.4	
<i>Renal Operations</i>	4 cases		4 cases	2 cases	4 cases
Serum CO ₂	28.81 ± 1.43		27.62 ± 0.89	26.32 ± 0.16	27.20 ± 1.31
Serum Cl	99.2 ± 1.4		100.1 ± 0.8	102.3 ± 1.9	99.8 ± 3.7
Total base	150 ± 3.4		149 ± 1.2	148 ± 1.8	147 ± 3.3
Serum protein	7.66 ± 0.23		7.48 ± 0.37	6.40 ± 0.11	6.68 ± 0.12
Serum potassium . . .	18.2 ± 1.19		19.7 ± 1.31	22.5 ± 0.32	18.8 ± 2.23
Serum lactic acid . . .	1.80 ± 0		6.15 ± 0.20	6.37 ± 0.20	2.32 ± 0.22
Haematocrit	42 ± 0.7		27 ± 3.9	31 ± 3.5	29 ± 2.3
Blood sugar	90 ± 5.1		173 ± 15.1	121 ± 7.4	118 ± 5.2
<i>Laparotomies</i>	5 cases		5 cases		
Serum CO ₂	28.43 ± 1.25		26.61 ± 0.95		
Serum Cl	103.6 ± 4.8		103.5 ± 5.9		
Total base	144 ± 4.9		147 ± 2.0		
Serum protein	6.71 ± 0.22		6.74 ± 0.19		
Serum potassium . . .	19.1 ± 0.57		19.4 ± 1.04		
Serum lactic acid . . .	1.42 ± 0.20		2.62 ± 0.73		
Haematocrit	30 ± 1.3		34 ± 2.4		
Blood sugar	114 ± 10.9		154 ± 18.0		
<i>Minor Operations</i>	4 cases		4 cases	2 cases	
Serum CO ₂	30.08 ± 1.68		29.10 ± 3.23	30.95 ± 0.51	
Serum Cl	100.4 ± 1.4		95.4 ± 2.4	101.6 ± 0	
Total base	148 ± 1.4		149 ± 0.8	147 ± 1.4	
Serum protein	7.70 ± 0.26		7.68 ± 0.34	7.88 ± 0.16	
Serum potassium . . .	19.2 ± 0.95		21.4 ± 1.65	18.4 ± 0.22	
Serum lactic acid . . .	1.90 ± 0.31		2.61 ± 0.26	2.22 ± 0.23	
Haematocrit	45 ± 2.4		42 ± 4.1	—	
Blood sugar	116 ± 5.5		131 ± 19.5	119 ± 13.1	

test tubes containing test mixtures of various specific gravity. The length of each test tube was approximately 20 cm; its caliber measured 17 mm. The test tube shows two graduations which were exactly 10 cm apart. The time the serum-drop took to cover the distance between these two marks was considered as falling-time. For the purpose of producing uniformly sized droplets of approximately 0.002 cc volume a pipet was used fitted with a micrometer-screw and a capillary tube. The test-mixture consisted of benzoene bromide and petroleum. The water solubility of this mixture was minimal. We have been using this mixture for the determination of the serum protein daily over a period of more than 6 months without its having any bearing on the accuracy of the method.

The falling time was recorded by means of a stop-watch graduated in 0.1 seconds. For each test five consecutive determinations of the falling-time were made. After having extracted the mean of these, the protein content readings shown on a curve, constructed from the protein values which were computed by the hypobromite readings, were checked. With this method temperature has a conclusive bearing on the specific gravity. We even found that a time factor had a bearing on the protein values inasmuch as in not freshly-drawn blood serum samples the protein values were considerably more elevated than in freshly-drawn ones. This emphasizes the importance of using the samples as shortly as possible after withdrawal.

The fact, that the protein value computed on the basis of 20 determinations made on one and the same serum sample amounted to 6.88 ± 0.05 per cent — this figure indicates a percentage of error of less than ± 1 per cent — is evidence of the accuracy of the method. If the methodical errors of the falling-drop method and the hypobromite method under the experimental conditions reported are compared the following figures will be computed:

Falling drop method.....	6.94 ± 0.26	per cent protein
Hypobromite method.....	6.89 ± 0.28	» » »

b) *Determination of the Sodium, Potassium, and Calcium Content of the Serum by the Flame-Spectrum Method.* (This analytical work was carried out in the Physiological Institution of Ultuna-Uppsala.)

In this study the cation content of the blood serum was partly determined by spectrum analysis. Thus, Na, K, and Ca were determined by *Lundegårdh's Flame Method*.

This physical micro-method is based on determining by photometry the intensity of the lines and the element content in emission spectra recorded spectrographically. After having photometrically determined on the photographic plate the spectra of a series of solutions of known concentrations a transparency curve is constructed on which the cation

content of a fluid (*e. g.* the cation content of a serum sample) can be graphically determined. One of us (NORINDER) succeeded in simplifying this method in such a manner, that the blood serum diluted with aq. dest. of known proportions could be directly used as basic material for quantitative analysis of the cation content.

The actual metals present in the flame image were determined by 30 analyses on one and the same serum with the following accuracy:

Ca	9.29 \pm 0.07 mg%
K	20.5 \pm 0.10 »
Na	296 \pm 2.4 »

d) *Determination of the Total Serum Bases.*

The total base determination was made by electrolysis according to KEY'S method modified by NIELSEN. When constructing the apparatus necessary for the total base determinations we followed NIELSEN'S instructions. Our apparatus permitted of simultaneously analysing 8 specimens.

In 15 determinations on one and the same serum this method was subjected to the following methodical error: 152 ± 1.67 milli-aeq. total bases.

e) *Determination of Blood Sugar according to Hagedorn's Method.*

This method is included in the routine analytical work of the Akademiska Sjukhuset of Uppsala. The majority of the determinations were made in the clinical laboratories of this hospital.

f) *Determination of CO₂ according to van Slyke's Manometric Method.*

10 cc venous blood was centrifuged in the presence of paraffin. 2 serum samples measuring 3 cc each, were transferred into a tonometer (ENGHOFF). After evacuating them to — 40 mm Hg, carbon dioxide was added until the pressure was levelled down. After saturation by rotation for 15 minutes 0.5 cc of this serum were transferred to van Slyke's manometric apparatus taking care that no air was included. Subsequent to each determination a blind test was made, and the possible carbon dioxide content of the reagents was subtracted.

In the present investigation the coefficient of variation in this method was found to be ± 2 per cent.

g) *Determination of Lactic Acid in the Serum according to Avery-Hasting's Method.*

4 cc of venous blood were withdrawn and immediately transferred into a tube of a centrifuge containing 1 cc of 5 per cent NaF (in the

absence of fluoride, lactic acid is formed as soon as 2 minutes later due to glycolysis. Thus the analytic values are increased five- to tenfold). 1 cc of this centrifuged solution was added to sodium tungstate and sulphuric acid and was centrifuged. After precipitating all glucose by adding CuSO_4 and Ca(OH)_2 the solution was oxidized in van Slyke's apparatus in the presence of potassium permanganate. By this procedure one molecule of lactic acid produces one molecule of CO_2 . This value was manometrically determined and reduced by 0.5 mM CO_2 , which corresponds to the carbon dioxide produced by other organic substances, which had not been precipitated by copper sulphate.

The coefficient of variation determined on a solution of lactic acid of known concentration was ± 3 per cent.

h) Determination of the Chloride Content of the Serum.

This determination was made by electrometric titration with N/100 AgNO_3 . The coefficient of variation was approximately ± 4 per cent.

III. Clinical Material.

Table I (p. 326—327) shows the type of cases, on which the reported investigations were made. The cases were classified in 9 groups. As regards diagnosis, surgical interventions and anaesthesia these groups are, as a whole, homogeneous. The first group includes 17 cases of gastric operations. 13 out of these were cases of ulcer, 4 were cases of tumours. 2 of these 17 cases were operated on according to Billroth's method I, 12 according to Billroth's method II. 13 cases of this group were operated on under spinal anaesthesia, 1 under local anaesthesia and 1 under ether narcosis. 2 cases of gastro-enterostomy (inoperable cancer) are included in this group. The second group comprises 17 cases on which both cholecystectomy and cholangiography were performed. 3 out of these were operated on under splanchnic anaesthesia; the remaining ones were administered spinal anaesthesia. On 2 cases even choledocholithotomy was performed. The third group includes the cases of struma. 11 out of these were of the toxic type and 1 was atoxic. All these cases were operated on under local anaesthesia. The fourth, fifth and sixth groups comprise 7 thoraco-plastic operations performed under Narcotal narcosis, 3 cases of cancer of the breast, likewise operated on under Narcotal narcosis and 4 cases on which plastic mammary operations were performed under ether narcosis. The group of renal operations (the seventh) includes 4 cases. On 1 out of these pyelolithotomy and on the remaining 3 nephrectomy was performed. 1 out of these cases was operated on under ether narcosis and 3 were administered spinal anaesthe-

sia. To the eighth group belong the cases of explorative laparotomy 2 out of these were operated on under Narcotal-, 2 under spinal- and 1 under local anaesthesia. The last group includes 4 cases of minor operations *i. e.* surgical interventions which do not cause severe laceration to the tissues.

Fluid and blood were administered on the basis of the usual clinical indications without taking the results of the present investigations into account. No doubt, this accounts for the comparatively inconsiderable difference in the analytic values obtained in the material reported in this paper, and for the fact that no shock occurred. On the other hand, this permits of considering the post-operative conditions observed in the present material as representative of the results of our routine method of treatment. It should be pointed out once more that we were not intent on elucidating pathological postoperative conditions, but merely the conditions in cases "which on the average were normal". We investigated the aftercourse without giving preference to any special conditions.

The percentage of primary mortality was inconsiderable. Only 2 cases died. One of these was a gall-bladder case, which will be reported later on in this paper. The other one was that of a woman aged 91 presenting ileus due to incarcerated hernia. The patient was moribund when she came to the hospital and exhibited shock symptoms already prior to the operation. She died immediately after the surgical intervention. The investigations prior to the operation yielded the following values: Alkali-reserve 21 mM, lactic acid 9.7 mM, blood sugar 190 mg per cent. The values immediately after the operation were: alkali-reserve 18, lactic acid 9.4, and blood sugar 190.

Table II gives a survey of the cases, grouped according to the means extracted from the values which were obtained by the individual analyses. These means were statistically compared. The mean errors were rather considerable. On the other hand, the statistical significance is more reliable because only these differences were considered to be statistically significant which were three times greater than the mean error.

IV. Discussion.

With the exception of the values of the lactic acid and the blood sugar, which both were significantly raised posterior to the operation, the other values prior and after the surgical intervention

Table II.

				Values before operations	Number of cases	Values one day after operation	Number of cases
Sodium	content of serum	mg%		310 ± 4.1	48	302 ± 5.2	28
Calcium	, , ,	mg%		9.68 ± 0.17	84	9.63 ± 0.15	15
Kalium	, , ,	mg%		19.9 ± 0.30	90	20.1 ± 0.31	63
CO ₂	, , ,	mM		29.5 ± 0.31	105	28.7 ± 0.36	68
Cl	, , ,	mM		102.5 ± 0.89	105	101.0 ± 1.11	63
Protein	, , ,	%		7.3 ± 0.08	105	7.4 ± 0.08	68
Total base	, , ,	maeq		147 ± 0.54	150	147 ± 0.74	66
Lactic acid	, , ,	mM		1.60 ± 0.08	43	2.76 ± 0.16	45
Blood sugar	, , ,	mg%		86 ± 1.59	42	135 ± 5.08	42
Haematocrit	, , ,	%		41 ± 0.79	40	42 ± 0.96	44

(Table II) show no statistically significant changes. The values of both sodium and carbonic acid content of the serum (alkali-reserve) were though statistically not significant lower after the operation. In the majority of the cases, however, carbon acid was decreased. From this observation it may as good as definitely be inferred, that the alkali-reserve after surgical interventions *tends* to decrease.

The dispersion in our material was too considerable to permit of expressing this depletion in terms of statistically significant figures ($D = 1.8 (D)$).

A study of the different groups of surgical operations yields the following results. (Table I, p. 326--327.)

1) *Gastric Operations.* In three cases the analyses were made immediately after the operation. There was a definite decrease of the values of the total bases from 145 to 130 which could not be interpreted as decrease in Na, K or Ca. A decrease in protein appeared to be probable (2.4 times the mean error), and there was an increase in lactic acid. It should be mentioned that there was a considerable increase in blood sugar (from 87 to 166 per cent). The hematocrit value decreased markedly (from 42 to 37).

24 hours subsequent to the operation there was a definite rise in blood sugar and lactic acid, 48 hours after the operation this rise is though less pronounced still appreciable; 3 days posterior to the surgical intervention, however, the values decreased again and the difference between the values before the operation and those after it were no longer significant. The other analyses did not reveal any definite change. As regards carbonic acid, however, *all the examined cases with the exception of 2 cases showed a decrease*

in the respective values which however was statistically not significant.

In 4 cases there was increase in the systolic blood pressure posterior to the operation, in 3 cases it was decreased (one of these was from the beginning hypertonic); the diastolic blood pressure, however, was increased in 6 cases; it was decreased in one instance only.

2. *Operations on the Gall-bladder.* With the exception of one case, in which the values of the alkali-reserve were approximately unchanged, the alkali-reserve readings showed throughout a decrease. The respective value, however, did not exceed the sum of twice the mean error. There was a definite rise of the blood sugar and lactic acid, otherwise the changes in the values were not statistically significant. Already on the second day after the surgical intervention the values of the lactic acid had decreased, even somewhat below the normal level, and the rise in blood sugar was no longer statistically significant. Three days subsequent to the operation, the values were the same as before the operation.

The systolic blood pressure was raised in 2 cases, it decreased in 5; 4 of the latter were hypertonics. The diastolic blood pressure rose in 2 cases, in 2 it was unchanged, and in 3 instances it decreased (the last mentioned instances were all hypertonics).

In 2 instances choledochus calculi had been revealed by cholangiography and were surgically removed. In one of these there was nothing noteworthy about the after-course, the other died of cholangitis and cholaemic haemorrhage. In this case the value of the alkali-reserve was remarkably low (20 mM) on the first day after the operation. The subsequent day, however, the value rose again to the normal level. There was nothing noteworthy about the serum protein and ion values. The hematocrit readings, however, were raised throughout the whole time in spite of haemorrhage. The behaviour of the blood sugar was interesting. Immediately after the operation it was 201; on the 5th day after the operation it had decreased to 127. After further 3 days there was a rise to 204, the patient's condition impaired and the blood pressure decreased. Peripheral stimulation of the vessels was inefficacious. Transfusion of large quantities of blood on two occasions, however, resulted in increasing the blood pressure and in general improvement of the condition of the patient. Nevertheless the patient died manifesting symptoms of sepsis; the post-mortem revealed cholangitis.

The hematocrit readings and the blood sugar values indicated in this instance at an early stage already the presence of shock and, therefore, the blood transfusions should have been made earlier.

3. *Strumectomies.*

In the 11 cases on which *strumectomy* was performed because of the presence of struma basedowi, there were no complications in the postoperative course. The decrease in the alkali-reserve, which was statistically not significant either in these cases was even less pronounced than in the cases of gastric operations and operations on the gall-bladder. There was a definite rise in lactic acid; the maximal values were recorded 48 hours after the operation (these findings were inconsistent with those recorded in the cases of abdominal operations, where the maximal values were observed after 24 hours). It was rather surprising that the rise in blood sugar, though fully appreciable, was statistically not significant. In anaesthesia of this type fairly large quantities of adrenalin are administered, which, however, per se do not appear to be the cause of postoperative hyperglycemia (The comparatively inconsiderable rise in blood sugar subsequent to splanchnic anaesthesia in operations on the gall-bladder points in the same direction; in such cases even larger quantities of adrenalin are administered.) The behaviour of the blood-pressure did not show anything noteworthy subsequent to these operations.

4. *Thoracoplastic operations.*

Subsequent to *thoracoplastic operations* (under Narcotal narcosis) which, as is known, range among the surgical interventions causing severe laceration to the tissues, there was a considerable rise in lactic acid. Maximal values were recorded 24 hours after the operation as well as a statistically significant rise in the blood sugar which did not appreciably decrease before the end of the third day subsequent to the surgical intervention. Otherwise, the analyses did not reveal any definite changes. Decrease in the blood pressure occurred equally often as rise in the blood pressure. It was a remarkable thing that the alkali reserve did not show any tendency to decrease after these operations.

5. *Plastic operations on mamma.*

Similar conditions were found subsequent to *amputations of the mamma* which were also performed under Narcotal narcosis. The

lactic acid was remarkably increased, but there was no definite increase in the blood sugar.

6. *Radical operations on mamma.*

The 4 cases on which *plastic operations on the mamma* were performed, were the only surgical interventions under ether narcosis. It was remarkable, that the alkali-reserve did not even show a tendency to decrease. The increase in blood sugar was not statistically significant, but the rise in lactic acid is obvious. There was a slight decrease in the serum protein on the second day, most likely due to haemorrhage.

7. *Renal operations.*

After 4 *renal operations* a very considerable rise in the values of lactic acid was observed. It was, in fact, the greatest rise recorded in the material reported. The alkali-reserve shows a tendency to decrease after these operations. There was even a very pronounced increase in blood sugar which was still fully appreciable on the third day after the operation. Most likely, the increase of blood sugar was caused by an irritation of the suprarenal gland. There was no increase in the blood pressure; if there was any change at all it was decreased rather. This might have been due to the fact that these operations caused a considerable loss of blood. The low postoperative hematocrit readings point also in this direction. The large quantities of fluid, which were parenterally administered in these cases, might furnish an explanation of the significant decrease in serum protein on the second and third day subsequent to the operation. It was, however, in no instance sufficiently great to lead to edema-formation.

8. *Explorative laparotomy*, which, as is known, causes but an inconsiderable laceration to the tissues, was made in 5 cases. There was an appreciable though rather inconsiderable increase in blood sugar and a moderate increase in lactic acid. The alkali-reserve showed a tendency to decrease, but the decrease was not statistically significant. It was least pronounced in the two cases operated on under narcotal anaesthesia (the remaining three cases were operated on under spinal anaesthesia). As regards the other values there was nothing noteworthy.

9. With the so-called *minor operations* (hallux valgus, hernia, fracture of the malleolus, nailing of the collum and so forth) there was no significant in the blood sugar; the lactic acid increased but

inconsiderably and the increase was statistically not significant. As regards the other values no definite variations were demonstrable.

V. Conclusion.

Since the material reported included practically only "normal cases" the recorded postoperative blood changes were but inconsiderable. *The increase in the lactic acid was the most striking factor*; it appeared to be proportional to the degree of severity of the laceration of the tissues caused by the surgical intervention. Since the break down products of the tissues play a certain rôle in the genesis of shock ("H-substances"), the rise in the value of the lactic acid may be considered as alarm signal, indicating that there is some risk of shock. It was significant, that the two cases resulting in death manifested very high values of serum lactic acid.

The second next interesting factor was *the postoperative increase in blood sugar*. It was most pronounced with the renal operations and was considerable even with laparotomies; subsequent to struma and operations on the thorax it was either less pronounced or completely absent. If hyperglycemia is really due *to the effect of adrenalin* — an assumption which is generally accepted — this is in good agreement with the results obtained with our analyses. Renal operations readily give rise to an irritation of the suprarenal glands. Laparotomies cause blood pressure changes in the abdomen. Manipulations with the viscera increase the permeability of the capillaries and tend to decrease the quantity of circulating blood. This would furnish the explanation of the speedy reaction of the sympatho-adrenal system. Even if this reaction is adequate, such an irritation is the reflection of an initial shock factor which obviously has to be taken into account subsequent to operations, especially after laparotomies. In one of our patients who died, the blood sugar rose after the surgical intervention; subsequently it fell to the normal level but later on it rose anew and, simultaneously with this rise, shock developed. With the exception of the cases which were hypertonics, *it may be inferred from the laparotomy cases reported in this paper that the blood pressure after a surgical intervention tends, as a rule, to rise* (chiefly the diastolic blood pressure). On the other hand, the effect of the quantities of adrenalin injected in local anesthesia does not seem to persist sufficiently long to cause considerable hyperglycemia.

The results of the determination of the haematocrit and the

serum protein did not help in any significant way towards throwing some light on the problem we were interested in *i. e.* on diagnosing shock at an early phase. Besides, this recognition is in good agreement with our previously advanced assumption that *increase in the capillary permeability and decrease in the serum protein values are phenomena which both occur at a late phase of the mechanism of shock* and should be considered as grave symptoms.

Changes in the cation content were not observed in the cases reported in this paper. These analyses demonstrated that the surgical interventions have no deleterious bearing on the capacity of the organism to maintain the ion equilibrium. It results therefrom that the results of these determinations are *no practically useful criteria of the early phase of shock*. Increase as well as decrease in both serum potassium and serum sodium subsequent to operations have been reported by numerous workers. On the basis of the uniform methods, which we used for our analyses we consider ourselves entitled to advance the view that, as regards these substances, no changes occur subsequent to a surgical intervention.

We could not demonstrate any statistically significant postoperative depletion of the alkali-reserve. Indeed, *depletion of the alkali-reserve was observed subsequent to practically all abdominal operations* and, to a certain extent — at least after these operations — it appeared to correspond to the increase in the lactic acid. On the other hand, struma operations and operations on the thorax demonstrate, that this *tendency to depletion of the alkali-reserve is not solely a consequence of the increase in lactic acid*. Although increase in the lactic acid is apt to occur subsequent to these surgical interventions the alkali reserve does not even show as much as an inclination to decrease. The majority of the abdominal operations were made under spinal anaesthesia. Since this kind of anaesthesia produces a transient circulatory failure it might be possible that it causes impairment of oxidation in the tissues and the accumulation of acid metabolites in these. Laparotomies which are followed by changes in the abdominal pressure may have a similar effect. The fact that the alkali reserve behaves in very much the same manner even subsequent to operations under splanchnic anesthesia supports the last mentioned assumption. Since depletion of the alkali reserve was most pronounced subsequent to operations on the gall-bladder it might even be influenced by the loss of alkali through drainage. This possible postoperative acidosis is not a symptom of shock. The acidosis in shock is a late symptom.

Summary.

1) The object of the present paper was to throw some light on the postoperative blood changes which are associated with shock. To this effect the interest was centered firstly on investigating whether the *surgical intervention per se* produced shock, secondly on segregating the earliest symptoms of shock at the initial stage of this condition. The clarification of these problems is of major importance for applying restorative and prophylactic measures in due time.

2) The pertinent investigations demonstrated, that extensive surgical interventions, chiefly gastric operations, operations on the gall-bladder, renal and, to a certain extent, even struma operations gave rise to postoperative hyperglycemia. These findings as well as the observations on the behaviour of the blood pressure suggested that there occurred a postoperative stimulation of the sympatho-adrenal system which should be considered as an early and compensatory symptom of shock and which is worthy of being followed-up.

3) The serum content of lactic acid increased considerably subsequent to extensive operations. This is due to the laceration of the tissue caused by the surgical intervention. Considering the etiological rôle, which the so-called "H-substances" play in the mechanism of shock, the increase in lactic acid is a significant criterion of the degree of severity of laceration.

4) Postoperative acidosis is of transient character and a factor of minor importance. In the reported cases it occurred in such a mild form, that it could not be statistically proved. Since, however, depletion of the alkali reserve was observed practically after all abdominal operations, particularly after operations on the gall-bladder, it may justly be assumed, that acidosis is apt to occur. It does not seem to parallel the increase in lactic acid, as it has not been observed subsequent to struma operations and operations on the thorax, where a marked increase in lactic acid occurs. It is, however, no symptom of shock.

5) The postoperative hematocrit readings and serum protein values did not suggest the presence of shock.

6) The investigations on the behaviour of the total bases, sodium, potassium, calcium and chloride prior and subsequent to the surgical interventions did not demonstrate any ion changes

(increase of potassium and calcium, decrease of sodium and chloride) which are characteristic of the fully developed condition of shock.

Zusammenfassung.

1. Die hier vorliegende Arbeit bezweckt einige postoperative Blutveränderungen, die u. a. auch beim Schock auftreten, klarzulegen. Hierbei richtete sich das Interesse erstens auf eine Untersuchung, ob der *chirurgische Eingriff an sich* Schocksymptome hervorruft, und zweitens auf möglichst frühe Feststellung initialer Schocksymptome. Die Klarlegung dieser Dinge ist von ausserordentlicher Bedeutung für möglichst frühe, evtl. prophylaktische, Behandlung.

2. Die Untersuchung zeigt, dass grössere chirurgische Eingriffe, besonders an Magen, Gallenwegen und Nieren, sowie in gewissem Ausmasse auch Kropfoperationen, eine postoperative Hyperglykämie hervorrufen. Dies im Verein mit dem Verhalten des Blutdruckes lässt vermuten, dass postoperativ eine Anregung des sympatho-adrenalen Systems vorliegt, was seinerseits als ein frühes kompensatorisches Schocksymptom anzusehen und der Verfolgung wert ist.

3. Die Milchsäuremenge im Serum steigt nach grösseren Operation bedeutend an. Dies ist durch die gewebsschädigende Wirkung des Eingriffs bedingt. Im Hinblick auf die ätiologische Rolle, die sog. H-Substanzen im Schockmechanismus spielen, stellt die Vermehrung der Milchsäure ein Mass für den Grad der Gewebsverletzung dar.

4. Postoperative Azidose ist vorübergehender Art und ein weniger bedeutungsvoller Faktor. Bei den hier untersuchten Fällen war sie so gering, dass sie sich statistisch nicht nachweisen liess. Da aber nach praktisch allen Bauchoperationen, besonders nach Gallenblasenoperationen, eine gewisse Herabsetzung der Alkalireserve beobachtet wurde, so ist immerhin als sicher anzusehen, dass eine gewisse Azidosetendenz vorliegt. Diese Azidose scheint der Milchsäurezunahme nicht parallel zu gehen, da sie sich nach Kropf- und Thoraxoperationen, wo eine ausgesprochene Milchsäuresteigerung im Serum vorkommt, nicht nachweisen lässt. Diese Azidose ist jedoch kein Schocksymptom.

5. Die postoperativen Hämatokrit- und Serumproteinwerte gaben keine Anhaltspunkte für einen Schockzustand.

6. Die Werte für Gesamtbasen, Natrium, Kalium, Kalzium und Chloride vor und nach Operationen zeigten keine für den aus gebildeten Schock typischen Ionenveränderungen (Zunahme von Kalium und Kalzium, Abnahme von Natrium und Chloriden).

Résumé.

1. Le présent travail vise à préciser certaines des modifications sanguines postopératoires qui se produisent également dans le shock. L'intérêt des auteurs s'est concentré d'une part sur la question de savoir dans quelle mesure *l'intervention chirurgicale par elle-même* provoque des symptômes de shock, et d'autre part de trouver les moyens de reconnaître le plus tôt possible les symptômes initiaux du shock. La mise au clair de ces problèmes est extrêmement importante pour instituer un traitement aussi précoce que faire se peut, voire un traitement prophylactique.

2. Les recherches montrent que les interventions chirurgicales majeures, principalement celles sur l'estomac, les voies biliaires et les reins, ainsi que, jusqu'à un certain point, celles sur les goitres, entraînent une hyperglycémie postopératoire. Cela, conjointement avec les phénomènes du côté de la pression sanguine, rend vraisemblable qu'on se trouve en présence d'une stimulation du système adrénalo-sympathique, laquelle à son tour doit être considérée comme un symptôme précoce et compensatoire lié au shock et mérite bien d'être suivie de près.

3. Le taux de l'acide lactique du sérum augmente considérablement après les opérations majeures. Cela tient à l'effet traumatisant de l'intervention chirurgicale sur les tissus. En corrélation avec le rôle étiologique joué par ce qu'on appelle les «substances H» dans le mécanisme du shock, l'augmentation de l'acide lactique est un indicateur du degré des lésions tissulaires.

4. L'acidose postopératoire est de caractère passager, et représente un facteur de moindre importance. Dans les cas examinés ici elle était si légère qu'on n'a pas pu la traduire statistiquement. Etant donné cependant qu'une certaine diminution de la réserve alcaline a été observée, pratiquement, après toutes les opérations abdominales, surtout celles sur la vésicule biliaire, il faut considérer comme hors de conteste qu'il existe une certaine tendance à l'acidose. Celle-ci ne semble pas marcher parallèlement avec l'ascension de l'acide lactique, puisqu'on ne peut pas la mettre en évidence

après les opérations sur les goitres ou le thorax où l'on observe une augmentation marquée de l'acide lactique du sérum. Du reste cette acidose n'est pas un symptôme de shock.

5. Les valeurs postopératoires trouvées à l'hématocrite et celles des protéins sériques n'ont donné aucun indice pour faciliter le diagnostic des états de shock. Les chiffres des «bases totales», sodium, potassium, calcium, ainsi que ceux du chlore, avant et après les opérations n'ont montré aucune des modifications des ions qui sont typiques du shock caractérisé (augmentation du potassium et du calcium, diminution du sodium et du chlore).

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On Acute Regional Enteritis.

By

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Introduction. Local, non-specific inflammations in the small intestine have been mentioned in scattered reports in the literature since the beginning of the last century. Major works have been published by SJÖWALL and FRISING (1913), HELLSTRÖM (1919) and BOHMANSSON (1923), partly on basis of their own, partly collected cases. These authors are mostly interested in the acute, purulent processes, severe cases, which most often ended fatally from peritonitis. However, already BOHMANSSON mentions that undoubtedly a number of mild cases remain undiagnosed and are cured spontaneously.

A division of these inflammations into groups has been proposed according to their location in 1) The duodenum, which lacks a free mesentery, 2) the jejunum-ileum and 3) the colon. — The duodenites are clinically closely related to the corresponding affections in the stomach. (They are not discussed in this work.)

However, the inflammatory processes in the jejunum may give a clinical picture so different from inflammations in the ileum that it seems natural to make a distinction between them. BOHMANSSON also emphasises that inflammatory processes in the upper parts of the intestinal tract take a more acute course than in the lower ones. PROBSTEIN and GRUENFELD are of the same opinion. But whether they really are different disease entities is a question that is not yet settled.

Interest in this subject has increased since CHRON in 1932 described 14 cases of "terminal ileitis". As well CHRON as many of the later authors chiefly dealt with chronic ileitis with a tendency to stenosis and fistular formation. Most of the publications

mention an acute *stage* with abdominal symptoms resembling those of acute appendicitis, but further details of the pathology and symptomatology of this stage are seldom given, and vagueness seems to prevail as to the relation between acute and chronic regional enteritis.

In 1929 STRÖMBECK described 22 cases of acute terminal ileitis, chiefly mild cases. He makes a distinction between ileitis simplex and phlegmonosa. In another work on ileitis in 1937 he discusses the possibility of acute ileitis being a precursor of the chronic form, but believed the initial symptoms of the latter to be of a different kind from that of the simple, acute ileitis. HARBITZ in 1938 maintained the same. He called upon control examinations of conservatively treated acute ileites to settle this question.

Other works on acute regional enterites have been published in the Scandinavian literature in recent years by KRISTOFF (whose 2 cases are included in the present material), BRYNJULFSEN, SONDERGÅRD, TALLROTH, HJORT and ANDERSEN. DOHLEN (1943) published a material of phlegmonous jejunites together with phlegmonous gasteroduodenites.

Pathology. Characteristic of the regional enteritis is a local, "segmental" inflammation in the wall of the small intestine, mostly solitary, but sometimes with multiple locations. The affected section may be from 10—20 cm up to $\frac{1}{2}$ — $1\frac{1}{2}$ m. The demarcation line against the healthy part of the intestine is sharp or indistinct. In the "terminal" ileitis the changes often cease abruptly at the ileo-cecal junction. The intestinal wall is the seat of inflammatory changes of various degrees, from a slight injection of the serosa and edematous thickening to a severe phlegmonous infiltration. The mesentery in some cases is edematous or infiltrated. Regional glandular swelling is common. The peritoneum is also affected to various degrees, from slight peritoneal irritation with serous exudate to severe, purulent peritonitis.

The histological picture is relatively seldom mentioned, at least for the acute ileites. Separate cases have been described by ERB and FARMER, JACKMANN, PETERS, KAJSER, and the intestinal phlegmons by BOHMANSSON. The inflammatory changes are most pronounced in the mucosa and submucosa, which as a rule are enormously thickened, in some cases essentially by edema, in others by inflammatory infiltration (leukocytes, occasionally chiefly eosinophiles, larger mononuclear cells, and in subacute forms plasmacells). The infiltration may spread through the

muscularis to the serosa. Mucosa sometimes is intact, but is often ulcerated, and in severe cases it may be shed. Development of intramural abscesses or gangrena is found in the most severe form of phlegmonous enteritis.

Etiology and pathogenesis have been discussed by all the authors pursuing this subject, without any final result having been obtained. On the basis of the clinical picture and the pathological findings, it has been assumed that the cause is an infection by some microbe, but a specific virus has not been demonstrated. Findings have been reported of various microbes in the intestinal wall and the peritoneal exudate, especially on inflammations in the upper part of the intestinal tract (in *HELLSTRÖM's* and *BOHMANSSON's* materials most often streptococci). But there are relatively few cases in the lower part of the ileum in which bacterial findings have been reported.

Bacteria have been demonstrated in the whole intestinal tract, in increasing amounts downwards. As it is a question whether bacteria pass a wholly intact intestinal mucous membrane, lesions of the mucosa by foreign bodies, *e. g.* fishbones, have been considered as a possible cause. However, foreign bodies have only in few cases been demonstrated in such inflammations.

A male, 52 years, was admitted to Ullevål Hospital, Dept. III. on $23/8$ 44. Since 1932 he had been anacid. 3 days previous to admission he had eaten a heavy meal of salmon. The next morning he had paroxysmal pain in the abdomen and nausea. The pain grew worse on the following days, and he was admitted with signs of a peritoneal irritation. On laparotomy, a thick, stiff loop with tubulary infiltration was found in the middle part of the small intestine, and the adjacent part of the mesentery was thick and infiltrated. The loop was surrounded by a thick, yellowish-brown exudate, fairly isolated by adhered omentum and small intestine. In the exudate there was deposited a fishbone; 4—5 cm long, quite unattached. The exudate gave growth of *Esch. coli* and fecal streptococci.

The pathologic-anatomical intestinal changes were here identical to those encountered in the acute ileitis. The fishbone had passed through the intestinal wall, without leaving any macroscopically perforation, and had caused a phlegmonous infiltration in the wall.

The acidity conditions in the stomach are presumed to play a part. Some authors have pointed to the possibility of anacidity as predisposing for intestinal phlegmons. But anacidity is no constant finding in these cases.

Some observations of acute ileitis in the course of acute infections may point in favour of occurrences of hematogenous infections, but are also explainable as a complication, produced by reduced resistance.

Some cases have been reported where the pathogenesis may be explained on the basis of an allergic condition (KALLIUS, KAJSER, TALLROTH).

STRÖMBECK assumed that for the simple, terminal ileitis no special cause is predominant, but the condition is rather an intensified reaction to irritants from the intestinal contents, a reactional mode typical for this part of the intestine with its special structure, rich in lymphatic tissue. However, this is no explanation of similar processes higher in the intestinal tract.

Symptomathology. The symptoms in regional enteritis generally vary somewhat with the location and degree of inflammation, and in the opinion of most authors, they are not very pregnant. In regard to the intestinal phlegmons BOHMANSSON states: "Any symptoms characteristic of the disease as such, are not to be found." The symptoms encountered in peritonitis, sepsis and ileus may also be met here. Onset of the disease as a rule is very acute, and is characterised by intense pain, indicating peritonitis from perforation.

Acute terminal ileitis usually offers, according to STRÖMBECK, symptoms and signs resembling those of an acute appendicitis. In most cases laparotomy is made on the basis of this diagnosis, which is natural, in the face of an inflammatory condition, localised to the right iliac fossa. In the "simple" ileitis the abdominal signs as a rule are slight. The finding at an early stage of a temperature unexpectedly high compared to the other signs is supposed to be a peculiar feature in many cases. Diarrhea is not usual.

The diagnosis therefore is difficult, and in the great majority of cases it has, until the present time, been made only on laparotomy. With more experience the roentgen examination should be of support. STRÖMBECK in 1941 discusses it essentially with regard to chronic ileitis, but reports cases in which he has been able to pronounce the diagnosis of *acute* ileitis by the aid of examination with peroral contrast medium. The ileal mucosa pattern becomes rough and oedematous. Swelling of the mucous membrane is most pronounced near the BAUHIN's valve, which

may be bulging into the cecum. FRIMANN-DAHL in 1943 described the roentgenologic picture of acute ileitis. The findings on a survey picture are in much suggestive of an acute appendicitis and in all essentials correspond to the changes designated peritoneal irritation. Peroral contrast medium was only used occasionally in his material. Delayed passage was found and perhaps a slightly abnormal mucosa pattern in the lower part of the ileum.

As for inflammations higher in the small intestine, the roentgen picture is more significant. The typical roentgen findings in acute jejunitis are, according to FRIMANN-DAHL, the following: The survey picture displays one or more distended, gas-containing intestinal loops, in location corresponding to the upper parts of the jejunum. They may contain fluid, and a picture with horizontal direction of the rays reveals fluid levels. Opposite the gas in the loops the plicae of the mucous membrane appear distinct, broad and elevated. The lower part of the small intestine and the colon may involve small fluid levels, indicating a peritoneal irritation. On repeated examination 1 or 2 hours after contrast medium pr. os, the changes in the jejunum appear even more clearly. The prominent plicae present a dented profile in the contrast. On later examinations a slow passage through the intestine, and retention of contrast medium in the distended loops for up to 24 hours may be shown. — The distended intestinal loops may call to mind an ileus. However, the loops in an ileitis are not of the typical narrow arched form as in an ileus, and the broad, elevated mucosa folds in jejunitis give a characteristic appearance to the intestinal loops, different from that of ileus.

The treatment of regional enterites has generally consisted of intestinal resection in the graver cases, most often with an exit in peritonitis as result, and exploratory laparotomy in the milder. Occasionally ileostomy is applied.

Control examinations of conservatively treated acute ileitis is carried out only to a small extent.

In 1937 STRÖMBECK has controlled clinically 22 cases with an observation time of an average of 4 years and ANDERSEN likewise in 1944 7 cases with an observation time of 1—6 years. None showed symptoms suggestive of transition into chronic condition or stenosis. For the rest only short series have been reported.

PROBSTEIN and GRUENFELD mention a case in which ileostomy was instituted because of an acute ileitis. When the fistula was closed on laparotomy 3 months later, all traces of the ileitis had disappeared. MEYER, ROSI examined 3 cases roentgenologically from 3 weeks to $1\frac{1}{2}$ year after exploratory laparotomy without finding any intestinal changes. HARBITZ examined 2 similar cases, one after $2\frac{1}{2}$ and the second after 4 months and demonstrated slight changes in the mucosa pattern and the outline in the lower part of the ileum.

The Author's Investigations.

The object of this work is first, through a study of a material of acute regional enteritis to offer a contribution to the pathology and clinics of this disease, and examine the possibilities for more certain diagnostics, and second, through control examination of conservatively treated cases, to trace whether the further course is spontaneous cure or transition into a chronic condition.

The material includes all cases that in the course of the period $1\frac{1}{1}$ 1936—³⁰, 44 in the surgical departments of Ullevål Hospital had a laparotomy for acute ileitis, 33 in all, and the cases that in the same period have been treated in Dept. III. for acute jejunitis, 8 cases in all.

In the course of this period only 1 case of chronic ileitis has been treated in the surgical departments.

Acute Ileitis.

Of the 33 patients 12 were male and 22 female. — (Distribution of the ages appears from Table 1.)

Table 1.

Age	0—10	11—20	21—30	31—40	41—50	51—60	> 60
Number . .	1	4	16	6	4	0	2

The 4 cases in the age-group 11—20 were all between 18 and 20 years. Most of the patients were between 18 and 40. (In STRÖMBECK's material 76 % were below 20 years, and hereof 44 % below 10 years.)

Symptoms. The main symptoms are abdominal pains, nausea and vomiting. $\frac{1}{3}$ of the patients (11) stated that they earlier

had had accesses of pain, more or less similar to that experienced at the time of admission, 4 of these only once. Duration of the present access before admission appears from Table 2.

Table 2.

Duration	12 hours	13—24 hours	25—48 hours	49—72 hours	> 3 days
Number of pat.	3	14	6	4	3

3 had felt slight discomfort for 1—2 weeks, with acute aggravation during the last 24 hours.

In $\frac{1}{3}$ of the cases the onset was sudden, in $\frac{2}{3}$ gradual. Almost $\frac{1}{2}$ of the cases (14) showed the typical shifting of the pain that is found in appendicitis: diffuse at the start and later localised to the right iliac fossa. — Location of the pain for the rest was: diffuse during whole course (4), to the right iliac fossa (10), the umbilical region (2), the epigastrium (2) and the entire lower abdomen (1).

Character of the pain was described as a constant ache (3) or a steady ache with paroxysmal aggravation (9). 10 had typical colic pain.

Nearly half of the patients (15) had vomiting, usually repeatedly, whereas 11 had nausea without vomiting. — Chills and diarrhea are rare symptoms (and occurred each in 4 cases). In no case had there been preceding periods with diarrhea.

The initial symptom in most cases (28) was pain, unfrequently nausea and vomiting (2) or a sense of discomfort and tenderness in the abdomen (3). No definite correlation was observed between the symptoms and the pathologic-anat. findings. "Spasms" of pain and vomiting occurred in patients in whom thickening of of the ileal wall and constriction of the lumen were not considerable, and the cases with chills were not among the most severe.

Signs. The conditions of temperature on admission appear from Table 3:

Table 3.

Temperature	≤ 37.5	37.6—38.0	38.1—39.0	> 39.0
Number of pat. . .	4	10	17	2

The pulse rate on the average corresponded to the temperature.

The abdomen: Tenderness was a constant finding. It was confined the right iliac fossa in most cases (26), extended to the entire lower abdomen in 5 and was more diffuse distributed in 2 cases. Tenderness in the Douglas pouch was present in rather more than $\frac{1}{2}$ of the cases.

Rigidity and tenderness on sudden release of pressure were demonstrated frequently (20 and 19 cases respectively). A palpable tumor in the right iliac fossa was found in 1 patient, in whom laparotomy disclosed besides the ileitis, typhlitis with considerable thickening of the cecal wall.

W. B. C. and sedimentation rate was determined on admission for 8 patients. Leukocytosis (with values between 11,000 and 16,000) was present 6 times. — 6 patients showed elevated sedimentation rates (between 21 and 65 mm./1 hr). Of these 3 had a history of disease of 24—36 hours.

On comparing the signs and pathologic-anat. changes no certain parallelism is found with regard to the temperature. A comparatively high temperature has been observed in many cases in which the changes in the ileum were only moderate, and vice versa. The abdominal signs corresponded, broadly speaking, to the degree of peritoneal irritation.

Roentgen examination of the abdomen with survey picture has been carried out in 11 patients. In 5 there were demonstrated signs of peritoneal irritation (small fluid levels in the ileo-cecal region). In 4 others there were observed signs of fluid in the abdomen without signs of peritoneal irritation. Of these 1 showed the shadow of a mass in the right iliac fossa (due to a thick, infiltrated cecal wall). In the other 2 the roentgen diagnosis read: "Slight colonic meteorism" and "Normal". — Examination with peroral contrast medium was made in 1 case. The intestinal passage was found delayed, as after 10 hours the contrast had reached the lower intestinal loops, when the examination was interrupted.

The operation indications were in the majority of cases (28) suspected acute appendicitis. For the remaining cases they were: Peritonitis, ileus? (no signs of ileus on survey picture), torsion of ovarian cyst? or appendicitis? (tumor in the right iliac fossa). The diagnosis of ileitis has in no case been pronounced previous to operation.

Findings on Laparotomy. Exudate in the peritoneal cavity was demonstrated almost regularly (29 instances), whereof 17

times clear, serous, and in amounts from "some" to "abundant", 8 times cloudy, 2 sanguineous-serous, 1 mucous and 1 purulent. Of 3 bacteriologically examined, 1 showed growth of coli.

The changes in the ileum were the following: injection of the serosa a constant finding, as a rule it was diffuse. Minor hemorrhages in the serosa were demonstrated relatively often (8) as well as a "granulated" or fibrin-coated surface (12). Pronounced thickening of the wall was present in the majority (27), sometimes only from edema, but in most as an infiltration, causing a stiffness of the wall, often of a rubber-like consistency. Usually the thickening was circular, "tubular", evenly distributed. The lumen might be constricted to some extent, but rarely much. Dilatation of the thickened area has been described only infrequently. In 1 instance a part of the ileum was thickened and dilated with discoloured patches in the serosa, and a punctual perforation was suspected.

Location of the changes was generally (31 cases) the terminal part of the ileum, most often with the ileo-cecal junction as the lower borderline. (20.) In 4 the lower limit lay 10—30 cm above the cecum, whereas in 4 cases changes were found higher in the ileum. In $\frac{1}{4}$ of the cases the changes spread into the cecum pouch, in the form of a diffuse or local thickening and injection and occasionally with a fibrin coat. The changes in the ileal wall occupied from 10 cm to 1 m.

In the mesentery edema was observed 4 times and hyperemia 3 times. Glandular tumor in the mesentery was described in 21 patients. But only in $\frac{1}{3}$ has the size of the glands been stated, varying from the size of a kernel of a nut to a walnut.

It is a fact that the size of the mesenteric glands presents great physiologic variations, and it is difficult in the individual cases to decide what falls within the limits of the normal variations.

The appendix was characterized as "normal" in $\frac{2}{3}$ of the cases whereas slight changes were found in $\frac{1}{3}$. The changes have never been of such a degree that an appendicitis might be thought to be the origin of the ileal inflammation.

The treatment consisted of: Appendectomy (29 cases), exploratory laparotomy (2), walling off the ileum with omentum (1) and intestinal resection (1). The latter was not a severe one, and resection must be considered as unnecessary. It will be briefly referred:

A female, aged 41, previously in good health, had 4 days before admission had a transient indisposition with vomitings and the last 18 hours abdominal pains. On laparotomy an abundant, serous exudate in the peritoneal cavity was demonstrated. A piece of the ileum, 10 cm, was extremely thickened and injected and was resected.

The mucosa was well preserved. On microscopic examination a severe edema of the intestinal wall was found, especially of the submucosa. In all layers there was infiltration of granulocytes, essentially eosinophiles, plasma cells and lymphocytes. In the submucosa and subserosa minor hemorrhages were noticed. There was no fibrosis.

The histologic picture might suggest an allergic reaction.

The *postoperative* course has regularly been the following: The pain has subsided in the course of a few days, and the temperature has fallen rapidly. $\frac{2}{3}$ of the patients have been afebrile after less than 5 days.

Control examinations. Out of 33 patients, treated for acute ileitis, we have succeeded in tracing 28 at a time after the operation, varying between $7\frac{1}{2}$ and 1 years. 18 have met in person for examination, whereas 10 have given information of their condition per letter. The former have undergone a general clinical examination and roentgen examination with peroral contrast medium, a couple also with barium enema. The sedimentation rate has been determined for all, and 15 had Ewalds test. The results have been put down in *Table 4*.

The age stated is that at time of the laparotomy. Under symptoms has been noted all abdominal trouble of which the patients have complained.

Case 1 had the symptoms of an ordinary gastrogenous diarrhea and kept well by using hydrochloric acid.

Case 10 had undergone an intestinal resection. She had occasionally fits of pain, but no roentgenologic sign of intestinal stenosis.

Case 15 had a gastric resection for duodenal ulcer 3 years previous to the appearance of her ileitis.

Case 19 is of special interest, as 9 months after the exploratory laparotomy, because of an ileitis, she was readmitted with an acute abdominal attack. Laparotomy revealed a gangrenous appendix. The intestine showed no signs of the earlier ileitis. — Case 21 is likewise of interest, as 2 years after laparotomy for ileitis she was admitted with symptoms of an ectopic pregnancy. On laparotomy the small intestine was examined and found in perfectly normal condition.



Fig. 1. *Jejunitis*. Survey picture. Recumbent position.
Distended, gas-containing jejunal loops with heavy,
prominent plicae.



Fig. 2. *Jejunitis*. Survey picture. Erect position.
Distended jejunal loops with fluid levels and heavy,
prominent plicae.

HOMB: On Acute Regional Enteritis.

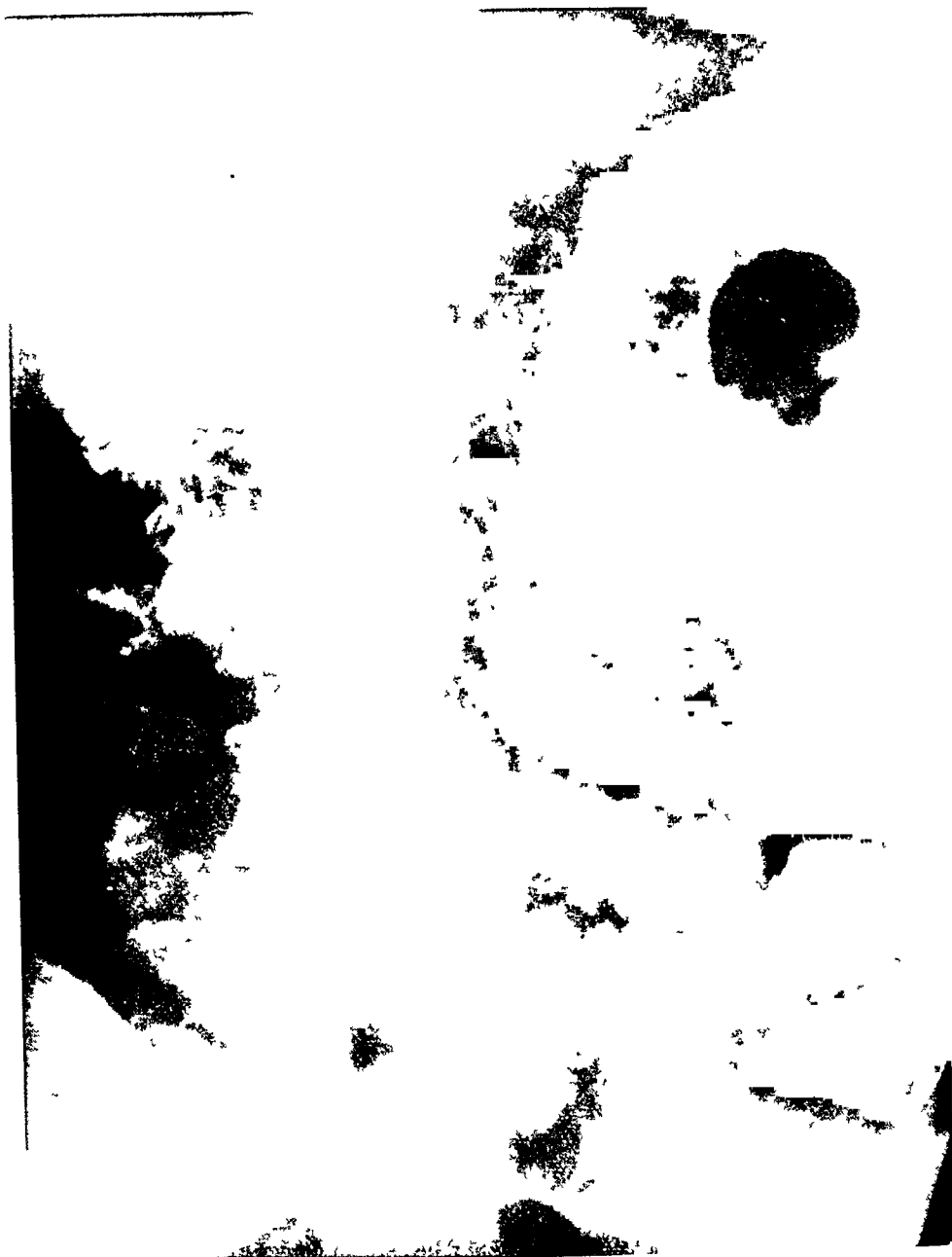


Fig. 3. *Jejunitis*. 4 hours after oral contrast medium.

On clinical examination no tumour in the abdomen, nor fistula or signs of intestinal stenosis have been shown in any of the patients, and on roentgen examination no signs of intestinal stenosis or changes in the intestinal mucosa pattern have been observed. In 6 instances the intestinal passage was found delayed. Of these patients 1 sometimes felt slight discomfort in the right iliac fossa, 1 suffered from meteorism, 1 had a ventral hernia, but was without symptoms. 2* were entirely symptom-free.

Of the total material, 5 patients, after discharge from the hospital, have had pain of such nature as to suggest some connection with the ileitis. Most have had trouble only the first months, whereas 1 had pain occasionally the first year. Possibly the ileitis in some individuals after termination of the acute stage, takes a more protracted course, as traces of the inflammation remain in the intestine, requiring more time for their retrocession. (HARBITZ' 2 cases may speak in favour of this explanation.) It must be noticed that all patients with a long observation time are symptom-free.

As for the *secretional conditions in the stomach*, the acid values were found normal in 9 cases, hypoacidity was met in 2 and anacidity in 4. Thus, anacidity is no constant finding in ileitis.

Acute Jejunitis.

The material comprises 8 cases, 6 male and 2 female, the ages between 24 and 63 years. — 4 had previously been healthy. 1 had 3—4 years ago had a gastric ulcer. 3 had had periods of abdominal pains and diarrhea for some time previous to admission.

Symptoms. Onset of the disease had been acute, in most sudden. (2 were admitted under the diagnosis perforated gastric ulcer.) The typical feature was severe pain in the epigastrium or over the entire abdomen with maximal pain in the epigastrium. Nausea was regularly present, and 6 had vomited repeatedly. Blood in the gastric contents was observed in 2 cases, and fetid gastric contents in 3, whereof 2 had a gastric retention of 3—400 ml. $\frac{1}{2}$ of the patients had diarrhea in connection with the pain, thereof 3 with melena. Chills occurred at the beginning of the attack in 2.

Signs. Most patients were in good general condition, but

Table

Case No.	Sex	Age	Obs.-time in years	Symptoms	
				At control examination	Previous
1	F.	20	7½	0	Diarrhea after heavy food.
2	F.	24	7	0	0
3	F.	23	6½	0	0
4	F.	26	6½	0	0
5	F.	23	6½	0	0
6	F.	23	6	0	0
7	F.	25	5½	0	0
8	F.	31	5½	0	Irregular stools and abd. pains first 2 years.
9	M.	26	5	0	0
10	F.	41	4	Occasionally fits of pain.	
11	F.	62	3½	0	0
12	M.	32	3½	0	0
13	M.	22	2½		One fit of pain 2 years after operation.
14	F.	42	2½	0	0
15	F.	35	2	Mild indigestion and occasionally pains in the rt. iliac fossa.	
16	F.	35	2	Mild indigestion and meteorism.	
17	F.	42	1½	0	0
18	F.	23	1½	0	0
19	F.	36	1½	0	2-3 fits of pain 1st 2-3 months.
20	F.	45	1½	0	Occasionally vague pains 1st year.
21	F.	25	1½	Rheumatoid pains in the rt. iliac fossa.	
22	M.	25	1	Slight fit of pain monthly.	
23	M.	20	1	0	Several months slight pains in the left iliac f.
24	M.	5½	1	Occasionally slight colic pains.	
25	F.	20	1	0	0
26	F.	24	1	Meteorism and flatulence.	
27	M.	24	1	0	Occasionally pains the first 4 months.
28	F.	34	1	0	Slight pains the first months.

4.

S i g n s					Remarks
Clinical	Roentgen	Contrast medium in cecum	Test meal	S. R.	
0	0		Anacidity.	2	Not examined. Not examined. Not examined.
0	0			40	
0	Delayed passage.	After 8 hrs.		32	Not examined. Not examined.
0	0		Anacidity.	6	Not examined. Intestinal resection.
Ventral hernia.	Delayed passage.	After 7 hrs.			
0	0		43/69	3	
0	0		40/60	7	
0	0		15/28	6	
0	0		Anacidity.	2	Gastric resection.
0	0		18/32	5	Not examined. Not examined.
0	0		16/24	10	
	Delayed passage.	7 hrs.	5/22	6	Relaparotomy after 9 months.
0	0		32/59	4	Relaparotomy after 2 years.
0	0				
0	Delayed passage.	5 hrs.	25/36	2	
					Not examined.
0	0		24/52	4	
0	Delayed passage.	7 hrs.	Anacidity.	4	
0	,	,	3/40	5	
					Not examined.

marked with pain. 2 cases with a fatal issue were in somewhat reduced condition. The temperatures on admission were found evenly distributed between 37.5 and 39.0, and the pulse frequency averagely corresponded to the temperature.

A considerable tenderness in the epigastrium and below the left costal arch was stated in the majority (6), but in 2 tenderness in the right iliac fossa. In astonishingly few (3) was rigidity observed as well as tenderness on sudden released pressure. But in 2 with a soft abdomen on admission increasing signs of peritoneal irritation later appeared. During the course a palpable mass developed in the epigastrium and below the left costal arch in 2 cases.

Strongly positive benzidin reaction in the feces or melena was demonstrated in 6 cases.

Roentgen examination has been made in 7 patients. In 5 the characteristic changes, previously mentioned, had been observed on a survey picture, which in 4 instances have been completed with examination with contrast medium. These cases were examined 3, 3, 5, 5, and 11 days after the onset of the disease respectively. 2 cases had been admitted to repeated examination, as on the first pictures, taken 12 and 24 hours after the onset respectively, only signs of peritoneal irritation were observed.

In 2 cases the diagnosis could not be pronounced on the basis of the roentgen examination. In the one instance examination 24 hours after the onset showed signs of a peritoneal irritation, and laparotomy was performed at once. In the other, examined after 9 days, signs of a perforational peritonitis were demonstrated. (The examination was unsatisfactory because of the poor general condition.)

The findings on laparotomy in 5 cases were inflammatory changes in the upper part of the jejunum of various degrees, and signs of peritoneal irritation or peritonitis. In all cases the intestinal wall was markedly thickened, injected and moderately distended. In all but one there appeared in the serosa transversally running stripes of more pronounced injections or subserous bleedings.

In the 2 mildest cases, which underwent laparotomy 9 days and 36 hours after the onset respectively, 20—30 cm of the jejunum was involved. The peritoneal cavity contained a clear exudate, sterile on culture. In the first case the mesenteric glands were enlarged.

In a third case, laparotomized 24 hours after the onset, 20 cm of the jejunum was involved. Serosa was fibrin-coated, and in one place a pin-head-sized, yellow patch was observed, interpreted as an intramural abscess. The peritoneal fluid was cloudy, and gave growth of hemolytic streptococci. The intestine was not resected, but covered with omentum.

In these 3 cases the symptoms rapidly receded after laparotomy.

In the 4th patient, laparotomy after 3 days' disease disclosed involvement of 1 m of the jejunum. The loops had adhered into a "cake", partly walled off by omentum. The mesentery was thick and infiltrated, rendering a resection impossible. Farther down the intestinal wall was injected and infiltrated in a 3—4 cm broad belt in an otherwise normal loop. The peritoneal exudate was cloudy and showed growth of *Esc. coli*. The peritoneal cavity was drained. Rise in temperature and increasing tumor below the left costal arch appeared, and the case went to exit 5 days later.

The 5th patient, admitted with melena and kept for observation in a medical department for a few days developed increasing signs of peritonitis. Laparotomy was performed 10 days after the onset. Here 75 cm of the jejunum was thickened and dilated with a few thinner, poorly nourished areas. In one of these there was a match-sized perforation. The peritoneal fluid was brownish, fetid, with growth of proteus. The thin areas were covered with sutures. After a transient improvement collapse and death supervened after 3 days.

Post-mortem examination revealed a diffuse, purulent peritonitis and progression of the inflammatory process in the upper part of the jejunum, which had adhered into a mass. Below the part that on laparotomy was found infiltrated, there were several circular infiltrations in the intestine, 5—20 cm in width, separated by bands of normal appearing intestine, 5—20 cm in width.

In all cases sulfathiazol treatment was instituted at once after laparotomy.

No connection between the duration of the symptoms and the degree of inflammatory process and its distribution has been found. After 3 as after 10 days have grave processes been met, leading to exit, and on the other hand, slight changes and a mild course after 9 days.

3 non-operated cases have shown symptoms and signs similar to the operated ones, as well as characteristic changes on roentgen examination, and the presence of a similar pathologic-anat. process in the jejunum as in the milder of the laparotomy cases is here taken for granted. In the non-operated cases also the symptoms have receded, sulphathiazol treatment been instituted. In one case the course was somewhat protracted.

Blood urea has been examined in 5 patients in the course of the first days in the hospital. In 4 cases increased values were shown. The azotemia may partly be thought to be due to the same mechanism as in bleeding gastric and duodenal ulcers, partly to the fact that in jejunitis there exists a subileus condition, because of the paresis in the stiff, infiltrated intestinal wall. This appears clinically in the gastric retention and roentgenologically in retention of contrast medium in the jejunum.

The acidity conditions in the stomach is examined in 7 cases, of which 5 showed anacidity and 2 normal acidity values.

W. B. C. was increased on admission in all patients but one. The values range between 13,000 and 36,000. *The sedimentation rate* was elevated on admission in the majority, ranging to 75. 2 patients examined 12 and 36 hours after onset of the disease showed sedimentation rates of 10 and 3 mm respectively.

Control examinations. Three operated and 2 non-operated patients have been re-examined from 9 months to 2 years after discharge from hospital. 3 are symptom-free, and clinical examination does not reveal any abnormalities. 1 has a slight non-characteristic dyspepsia and is anacid. 2 patients have periodically had abdominal pain and diarrhea. Both are anacid. In the one case roentgen examination with peroral contrast medium $1\frac{1}{2}$ year after the operation did not reveal pathologic changes in the jejunum. Sedimentation rate has in all cases been within the normal limits, and the benzidin reaction in the feces negative.

The scanty material and the short observation time does not permit any conclusions as to the tendency to transition into chronic state.

Summary.

A review is given of the symptoms and signs and the pathologic-anatomical findings in acute, regional enteritis. It is claimed that the clinical picture and course of acute jejunal and ileal inflammations may be so different as to justify a division of these conditions into jejunitis and ileitis. The work has been based on a material of 33 cases of ileitis and 8 cases of jejunitis.

Acute terminal ileitis, as regards symptoms and signs, resembles acute appendicitis to such a degree that the diagnosis rarely will

be made preoperatively. The roentgenologic changes observable in a survey picture of the abdomen have in the present material been no different from what is found in acute appendicitis. It is possible that on examination with contrast medium one might improve the diagnostics.

Acute simple ileitis as a rule is a transient affection, spontaneously cured. On control examination of 28 laparotomized acute ileites after $7\frac{1}{2}$ —1 year, no clinical nor roentgenological signs of transition into chronic condition have been demonstrated.

Acute jejunitis may present a clinical picture in many respects different from other abdominal ailments. It may be possible to pronounce the diagnosis without laparotomy, as the roentgen examination may reveal typical changes. Acutely appearing pains in the epigastrium, vomitings that may be fetid and contain blood, diarrhea with positive benzidin reaction in feces or melaena, fever, tenderness in the epigastrium and below the left costal arch, leukocytosis and elevated sedimentation rate ought to direct attention to the possibility of an acute jejunitis.

Acute jejunitis has in the present material had a more serious facies morbi and a more violent course than acute ileitis.

Finally I wish to express my gratitude to the chief surgeons CARL SEMB M. D. and CHR. ROSING BULL M. B. for their permission to make use of the material from their departments, and to the chief of the department of roentgenology, J. FRIMANN-DAHL and his assistants, who have performed the roentgen examinations.

Zusammenfassung.

Es wird eine Übersicht gegeben über subjektive und objektive Symptome und patol. anat. Befunde bei akuten, regionalen Enteriten. Es wird behauptet, dass das klinische Bild und der Verlauf bei akuten Entzündungen in Jejunum und Ileum so verschieden sein kann, dass man dazu berechtigt ist diese Zustände in Jejuniten und Ileiten einzuteilen. Die Arbeit ist auf einem Materiale von 33 Ileiten und 8 Jejuniten begründet.

Das Krankensbild und die objektiven Befunde bei akuten Ileiten gleicht dermaßen dem Bilde bei akuten Appendiciten dass die Diagnose beinahe immer erst durch Laparotomie gestellt wird.

Bei Nachuntersuchung von 28 laparotomierten akuten Ileiten nach $7\frac{1}{2}$ —1 Jahr sind klinische und röntgenologische Zeichen,

die auf Übergang in kronischen Zustand deuten, nicht gefunden.

Dagegen kann der akute Jejunit ein Krankensbild geben das in verschiedenen Weisen von anderen Abdominalkrankheiten abweichen kann. Die Diagnose kann durch Röntgenuntersuchung bestätigt werden, da das Röntgenbild typische Änderungen geben kann.

Résumé.

On donne un aperçu sur les symptômes subjectifs et objectifs et sur les constatations pathologiques anatomiques aux entérites régionales aiguës. On prétend que l'aspect clinique et le développement quand il s'agit d'inflammations aiguës du jéjunum et de l'ileum, sont si différents qu'il est à sa place de diviser ces états en des jéjunites et des iléites. Le travail se base sur une matière de 33 iléites et 8 jéjunites.

L'aspect de maladie et les constatations objectives à l'iléite aiguë ressemblent tellement à l'appendicite aiguë que, presque toujours, le diagnostic ne se fait que par laparotomie.

A l'examen postérieur de 28 iléites aiguës 7 ans $\frac{1}{2}$ à 1 an après laparotomie explorative aucun signe d'un développement vers l'iléite chronique n'a été démontré, ni comme signe clinique ni moyennant des rayons X.

La jéjunite aiguë, par contre, donne temps en temps un aspect a peu près caractéristique, et le diagnostic pourra être vérifié aux rayons X, étant donné que ce dernier procédé peut démontrer des changements typiques.

Les symptômes et les développements ont, dans cette matière, été plus graves et plus violents à la jéjunite qu'à l'iléite.

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The Problem of Surgical Arrest of Massive Hemorrhage in Peptic Ulcer.

By

GÖSTA BOHMANSSON, M. D.

The treatment of acute hemorrhage due to peptic ulcer has for many years been the subject of discussion, and widely divergent opinions are still held by the advocates of active surgical intervention, on the one hand, and those who recommend expectant medical treatment, on the other.

In a number of earlier studies, most recently at the meeting of the Swedish Surgical Society in Örebro in 1939, I have made known the results of surgical treatment of acute hemorrhage in ulcer conditions, a problem that since 1919 has been a subject of great interest at the hospitals where I have served as surgeon. My conclusions are based on slightly over 200 cases of hemorrhage due to ulcer, submitted to operation in an acute stage since the surgeons and internists in attendance agreed as to the danger of continued expectant treatment, compared with the results of conservative treatment recorded at the Medical Service in Örebro from 1929. Certain factors that have arisen during the past seven years should be borne in mind in deciding for or against operation.

ALLEN has analyzed 628 cases of manifest hemorrhage, in 200 of which the flow of blood was so intense that it led to advanced anemia. Shock developed in 138 of ALLEN's 628 patients. Twelve of them bled to death before an operation could be performed and 8 of them were operated on in the agonal stage. In 65 percent of the fatal cases the hemorrhage was the first one to occur, a point that has been stressed by other workers also (HESSER, ÅKERBERG).

RESCHKE had a normality of 9.5 percent in 1,000 cases of severe hemorrhage from ulcer collected in Berlin in the years 1934 and 1935.

In several papers MEULENGRÄCHT has emphasized that conservative treatment, with a diet consisting of high-caloric strained foods and vitamins B and C, combined with transfusions, gives such good results that operation is unnecessary. With this treatment his mortality was only 1 percent in his series of cases of hemorrhage from ulcer. The primary material is not classified according to the severity of the hemorrhage and is therefore not directly comparable with other statistical surveys. This principle of treatment, first introduced by LENHARZ and ISRAEL HOLMGREN appears still to be generally accepted, particularly in the Scandinavian countries.

Of greater interest in this connection are the statistics for the mortality in all cases of manifest hemorrhage. The following table shows some of the results achieved by the internists:

Table 1.

Mortality in manifest hemorrhage from ulcer.

Internal treatment	Food	Starvation
WESTERMANN (1935)		70 percent
HESSER (1939)	3.9 percent	
CHASNOFF (1940)	4.76 percent	11.2 percent
WANGENSTEEN (1940)		approximately 10 percent
BOHRER (1941)		17.5 percent
SCHIFF (1944)	6.8 percent	25.6 percent
MOSSBERG, Örebro (1933)		9 percent
MALMROS, Örebro (1945)	4.7 percent	

Treatment by diet, fluid and blood transfusions has considerably improved the prognosis with conservative treatment. In an analysis of the fatal cases during an earlier period in Örebro, MALMROS presented several fatal cases as typical examples of dehydration. These considerably improved results have strongly influenced our attitude to the operative indications. Treatment by food has been used in Örebro since 1936. Since 1939, when the benefits of this form of therapy were recognized and became a factor in considering the operative indications, the frequency of operations in manifest hemorrhage has dropped from 45 percent to 7 percent. It is noteworthy in this connection that at

this hospital a surgeon and an internist always consult on the operative indications in each case, and the choice of therapy therefore represents their joint decision.

Although treatment with food and fluid as well as blood transfusions is certainly of great value, it is nevertheless not possible to save all cases with this method. There always remains a category in which medical therapy is helpless, but in which a radical surgical intervention offers a chance of saving the patient's life by preventing another fatal hemorrhage. Even devoted followers of the MEULENGRACHT method recognize this fact. SCHIFF pointed out that some of the patients continue to bleed, and that this form of hemorrhage can lead to death.

THRE recommends operation in the event of a repeated massive hemorrhage in patients over 40 years of age in whom a niche has definitely been demonstrated. He found ten deaths among 267 cases of hemorrhage. RÖMCKE noted a mortality of 30 percent with internal treatment of repeated severe hematemesis or melena.

CHASNOFF showed that the frequency of perforations during the cure is as high as 9.5 percent with the Meulengracht method.

FINSTERER, who for many years has strongly advocated early operation in hemorrhage due to ulcer, is of the opinion that the surgeon should not let himself be influenced by mortality statistics based on series including all categories of hemorrhage. He claims that series of cases treated conservatively are not comparable with material in which the treatment has been surgical. He emphasizes the considerably better results achieved in cases submitted to operation within 48 hours.

In an analysis of my material of 140 cases operated on for hemorrhage, ÅKERBERG (1939) showed that one half of the deaths were due to shock, the other half to sutural insufficiency and secondary peritonitis. Later experiences with shock and its treatment have revealed that considerably larger and more frequent transfusions are required to relieve this condition than we previously believed. Since 1939 we have been giving transfusions of 1.5 to 2 liters in shock and have not lost one operated case from this complication in the category under discussion. Sutural insufficiency has also been conquered. Maintenance of the fluid balance with a view to avoiding acidosis and hypochloremia and, probably most important, hypoproteinemia, and early treatment of these complications if they develop, has made it possible for healing to progress undisturbed. Daily laboratory

analyses are of invaluable help in determining the exact lines along which the treatment should be conducted.

Still another factor is important in deciding on the operative indications in the cases under discussion, namely, roentgen examination at an early stage. It is generally agreed that callous ulcers, particularly those exhibiting gross vascular erosion, are especially dangerous, and that the operative indications in hemorrhage are strengthened by this finding. Since 1930 we in Örebro have made a practice of early roentgen examination. We have found that the demonstration of a niche gives us a safety margin of 98 percent, while a negative roentgen finding permits exclusion of deep wall changes in 95 percent of the cases examined. In no case has the roentgen examination been complicated.

Opinions differ greatly as to the site of the ulcer in the threatening cases. IHRE and RÖMCKE found a predominance of gastric ulcers, and HANSEN and PEDERSEN observed this type in 78 percent of the fatal cases. Of our series of operated cases, 80 percent showed the duodenum to be the site of the ulcer.

In order to choose cases suitable for operation and to weigh the risks of operation against the risks of continued medical therapy, it is necessary to select a special group of cases for the purpose of comparison. It is generally agreed that operation on the indication of hemorrhage does not come into question in cases of occult or manifest hemorrhage that do not affect the general condition and do not cause shock or grave anemia, nor in cases in which the bleeding can be checked promptly by internal treatment. The same also applies to the category in which general or special contraindications for any form of surgery are present. In this category belong the following cases, which include all the fatal cases of hemorrhage due to ulcer that have occurred in Örebro since 1939 and in which we agreed that operation was contraindicated:

1. Med. 1901/1940. 54-year-old man with cerebral hemorrhage and mental derangement. Died from hemorrhage from an eroded artery.
2. Med. 498/1942. 63-year-old man with hypernephroma and cachexia.
3. Med. 2515/1942. 67-year-old man with cardiosclerosis and cystic kidneys. Died from arterial hemorrhage.
4. Med. 568/1943. 78-year-old man. Died from arterial hemorrhage.
5. Med. 2352/1944. 71-year-old man. Very senile. Died from hemorrhage from the hepatic artery.
6. Med. 2480/1944. 79-year-old man with aortic stenosis and interventricular block. Death was not from hemorrhage.

7. Med. 3162/1942. 70-year-old woman with cirrhosis of the liver and thrombosis in one auricle of the heart.

8. Med. 451/1944. 65-year-old man with callous ulcer and pyloric stenosis. Death was not from hemorrhage.

9. Surg. 1788/1943. 51-year-old man operated on for perforated ulcer. Following the operation there was an acute hemorrhage from a second ulcer that had been overlooked. Died in hemorrhagic shock.

10. Med. 1344/1945. 65-year-old man, operated on 25 years previously according to the Billroth method II. He was admitted for manifest hemorrhage of uncertain origin. Roentgen examination of the stomach was negative. Died from acute hemorrhage. Autopsy revealed a duodenal ulcer with arterial erosion and hemorrhage. His life might have been saved by an operation.

11. Med. 610/1945. 68-year-old woman with severe cardiosclerosis. Died from a superficial ulcer in the mucosa with arterial erosion.

The following groups include the cases in which we recommend that operation be considered in order to prevent further hemorrhage:

I. Cases in which roentgen reveals a niche, in which there has previously been perforation, or in which a definite diagnosis of callous ulcer has been made at an earlier date, and which exhibit one of the two following characteristics:

a) serious periodical hemorrhages in the course of a cure with diet,

b) severe anemia with continuous hemorrhage and decreasing serum protein levels.

II. Cases of hemorrhage which brings the blood levels below the shock threshold and in which it is difficult to raise the blood pressure with transfusions.

Operation should be carried out in these cases in the absence of general, definite contraindications such as advanced age and senility, as well as serious complicating diseases of other organs. Operation is more strongly indicated if the patient is over 40 years. However, this age limit is only relative, since hemorrhage can be fatal in younger patients also (cf. Case Histories Nos. 5, 14, 16, 17, 18, 19).

Relief of shock is the first step. This is achieved by transfusions of blood, plasma or serum in adequate doses. At the same time the head is lowered and oxygen is administered. For the past year we have been successfully using the plasma substitute, dextran. Transfusions of crystalloid solutions such as physiologic salt or glucose have only a temporary effect and may be directly

harmful in the presence of low serum protein levels. Whole blood is preferable for transfusions in severe anemia.

The objective of the operation is exact hemostasis, resection or excision; further hemorrhage must be prevented. Palliative measures are of no value. Operation should be done as quickly as possible after the shock has been suppressed. The risk of operation under these conditions is not essentially increased, in our opinion; but the danger of another hemorrhage is great.

We operate according to Billroth's first or second method, preferably the former. The importance of a quick operation that spares the patient as much as possible is generally agreed upon. We therefore use spinal anesthesia according to Sebrecht's method, which we find least strenuous for the patient. Intravenous injections of fluid are given during the operation to counteract decreasing blood pressure.

Repeated blood transfusions to combat the anemia are indicated after the operation. The serum protein levels and the carbon-dioxide level must be carefully checked; a tendency to disturbances in these values demands adequate parenteral supply of fluid. Oral feeding should be instituted as soon as possible. Strained foods, vitamins B and C, high-protein nourishment, possibly Aminosol or other easily absorbed amino-acid preparations, are suitable. The toxic effect of disintegrated blood in the intestine should, according to PAUCHET, be eliminated, and this we find is best achieved by avoiding hypoproteinemia and thereby restoring the intestinal function as quickly as possible. We have not used the intestinal lavages nor the cecal fistula recommended by PAUCHET.

In cases in which the operation is preceded by long and profuse bleeding, the protein content of the cells is greatly depleted. This lack of protein is especially hard on the liver, the protein-forming capacity of which is decreased. In these cases the serum protein level remains low for a long time and can only be raised temporarily no matter how large plasma transfusions are given. At times the serum protein drops to the edema threshold, or even below it. The outlook in these cases is poor, and there is a danger of sutural insufficiency and secondary peritonitis due to edema in the intestinal wall. One case, in which there had been hemorrhage for three weeks before the operation and a low serum protein level after it despite large daily transfusions, ran an especially stormy course; the abdominal wound ruptured on the tenth

day, and the picture was complicated by extensive edema. Altogether six liters of blood or plasma were given over a period of twelve days before a change for the better could be noted.

The answer to the question of which cases should be treated operatively can probably be formulated as follows: it is the duty of the surgeon to try to save the patient from bleeding to death in cases in which the internist admits defeat and believes that continued hemorrhage will endanger the patient's life. That the operative mortality under these conditions will inevitably be high cannot be denied. However, it seems to be equally certain that if the surgeon refuses to treat these poor operative risks, the total mortality of the hospital will rise. The total mortality of various hospitals should be compared rather than the mortality of the different departments. Internist and surgeon alike should share the responsibility and should therefore cooperate in arriving at the operative indications and the plan of treatment. This is illustrated by the following survey of the Örebro material for the years 1929 to 1945, including 539 cases of manifest hemorrhage from ulcer. The division of the series into two periods is based on the principles of treatment, as already described. Since 1939 all cases of hemorrhage are treated with food, they are all submitted to roentgen examination as soon as possible, and shock treatment and fluid balance are handled along the same principles.

What has been the result of this program?

The total mortality has decreased from 9.1 percent to 5.1 percent.

The number of operated cases has decreased from 45 percent to 7 percent of the total.

The mortality for conservatively treated cases has decreased from 6 percent to 5 percent, the postoperative mortality from 13 percent to 5.2 percent.

Table 2.

Manifest hemorrhages due to ulcer and the mortality in percent at Central-lasarettet, Örebro.

Treatment	1929 to 1945	1929 to 1938	1939 to 1945
Medical	380 (5.5 %)	166 (6 %)	214 (5 %)
Surgical	159 (11.9 %)	140 (13 %)	19 (5.2 %)
Total	539 (7.4 %)	306 (9.1 %)	233 (5.1 %)

From a survey of the fatal cases during period II, it appears that one the eleven might possibly have been saved by operation

(No. 10). If the fatal cases are compared with the operated, it seems justified to conclude that during this period the hospital succeeded fairly well in selecting for operation the cases best suited for this treatment and can scarcely be said to have shown negligence in not operating in the cases that ended fatally. The mortality in the cases which not were hopeless from the outset was two out of 223 or 0.9 percent.

A further question of importance is the choice of the time of the operation. FINSTERER stressed that it should be performed as soon as possible. His mortality for two series of approximately the same size as our was 4.2 percent of the cases operated on within 48 hours, but 32.7 percent for the cases in which a longer period elapsed.

I have already touched on the risk of secondary sutural insufficiency entailed by chronic anemia and protein marasmus, which very often develop following protracted bleeding.

As a rule the internist prefers to postpone operation as long as possible, while the surgeon favors operating as soon as possible. Therefore, in the interest of the patient, the two, each knowing his own and the other's possibilities as well as limitations, should cooperate and shoulder the responsibility jointly. It would seem that the internist's objective should be not to lose any cases postoperatively because operation was done too late, while the surgeon's aim should be to operate only in cases where there are vital indications for operation and to be able to justify his decisions against operation by autopsy material from the medical service proving that operation would have been fruitless. These objectives are difficult to attain, but are well worth the effort.

In conclusion, I would take this opportunity to thank Dr. H. MALMROS, my internist colleague, and Dr. O. WILANDER, head of the laboratory, for allowing me to use their material and for their close collaboration along the lines described above.

A brief summary of the operated cases is given below:

A. Cases with gross arterial erosion.

1. Surg. 1005/1939. A 62-year-old man, with a history of untreated ulcer for three years. Admitted April 6 for severe hemorrhage. Roentgen examination was a failure, since the stomach was full of clots. Second hemorrhage on April 7. Shock developed. Billroth's second operation was done. There was a niche in the stomach with a bleeding artery. Discharged healed.

2. Surg. 271/1939. 53-year-old woman. Duodenal ulcer in 1938, for which patient underwent a cure. Admitted in 1939 with signs of peritonitis. Duodenal ulcer with severe hemorrhage and threatening perforation was diagnosed. Billroth's second operation was done revealing a duodenal niche with arterial erosion. Discharged in good condition.

3. Surg. 1024/1939. 42-year-old man. Perforating ulcer in 1935. Admitted in 1939 in hemorrhagic shock. Internal treatment. Bleeding continued and progressive anemia developed. Billroth's first operation was done revealing a duodenal niche with arterial erosion. Discharged healed. Second hemorrhage in 1942. Roentgen examination was negative. Internal treatment was given.

4. Surg. 3259/1941. 50-year-old man. Two big hemorrhages during a cure in the medical service. Admitted to the surgical service on November 11, pale and cold and unresponsive. Hemoglobin, 28 per cent, blood pressure, 75. Billroth's first operation was done following transfusion of 1,700 cc blood and plasma. There was a duodenal niche reaching into the pancreas. The pancreatico-duodenal artery was severed. Double ligation was done. Discharged healed.

5. Surg. 2853/1942. 29-year-old man with ulcer of seven years' standing. Referred from the medical service for repeated periodic hemorrhages during a cure. The serum protein level was low and the patient exhibited anemia and edema. Roentgen showed a duodenal niche. Billroth's second operation was done revealing a crater reaching into the pancreas with arterial erosion. Discharged healed.

6. Surg. 3081/1944. 68-year-old man with gastric ulcer and repeated hemorrhages. Earlier the same year he underwent a cure in the medical service. He was admitted unconscious for acute hemorrhage and grave shock. Excision and pyloroplasty were done following a transfusion. Perforating gastric ulcer with hemorrhage from a large artery was present. Discharged healed.

Later Billroth's second operation was done for stenosis at the site of the pyloroplastic intervention.

7. Surg. 4026/1943. 49-year-old man underwent an ulcer cure in 1942 for duodenal ulcer. Discharged in good condition. Readmitted on November 22, 1943, after two weeks of premonitory symptoms and hematemesis the previous day. Roentgen on November 23 revealed a niche in the duodenal bulb. There was another hemorrhage during the evening of the 23rd. Shock developed. A transfusion of 600 cc. of blood had a good effect. On November 24 there was another hemorrhage, shock developed, repeated blood transfusions were given, and Billroth's first operation was done (ODÉN). There was a niche in the posterior part of the pylorus reaching into the pancreas. Blood spurted from the main trunk of the pancreatico-duodenal artery. Double ligation was done. The postoperative condition was good. More blood transfusions were given. On November 28 the patient felt well and had a spontaneous evacuation. The patient took a sudden turn for the worse, went into shock and expired the same day despite blood and plasma transfusions.

Autopsy revealed purulent bronchitis and bronchopneumonia. The operative area showed nothing of note.

8. Surg. 429/1944. Obese man of 53 years with a large callous gastric ulcer and pulmonary tuberculosis. There had been severe hemorrhages during a cure in the medical service. Billroth's second operation was done, revealing a large duodenal niche with arterial bleeding. The patient was discharged cured.

9. Surg. 3822/1945. 65-year-old man with ulcer of ten years' standing. He underwent a cure with novoprotein injections for ten weeks in 1945. Cardiosclerosis and hypertonia were present. A niche at the angulus was not affected by the cure. He was admitted to the medical service on November 4, pale and shocked; the hemoglobin was 30 percent and there were 1,200,000 erythrocytes. Serum protein was 59, the sedimentation rate 8 mm in one hour. Two transfusions of 400 cc blood were given and the patient improved. The next morning he was again in shock. A surgeon was consulted. The patient was very pale and unconscious, did not react and exhibited severe dyspnea. The pulse was scarcely perceptible. The shock was relieved with 800 cc of dextran. Billroth's first operation was done revealing a niche at the angulus and arterial erosion.

During the convalescence treatment for shock was combined with daily transfusions of blood to counteract the hypoproteinemia (5.02 mg percent), which was stubborn. Discharged healed.

B. Cases with a niche but without gross arterial erosion.

10. Surg. 673/1942. 58-year-old man. Ulcer for three years. Admitted to the medical service for hemorrhage. Roentgen revealed duodenal ulcer. After a three-week cure there was another big hemorrhage. The hemoglobin was less than 20 percent. There was peripheral edema. The serum protein was less than 5 mg percent; repeated transfusions of whole blood raised this level above 6 mg percent. Billroth's second operation was done on March 3 when the patient had recovered from shock and revealed a duodenal niche reaching into the pancreas. Discharged healed.

11. Surg. 3111/1943. 55-year-old man. Symptoms for six years. Admitted in shock for severe hemorrhage and threatening perforation. Billroth's first operation was performed immediately revealing a penetrating duodenal niche. Discharged healed.

12. Surg. 2554/1944. 66-year-old man. Cure in 1942 for indolent gastric ulcer. Admitted for gastric hemorrhage. During the cure he had another hemorrhage resulting in shock. Billroth's second operation was performed revealing an enormous gastric ulcer. Discharged healed.

13. Surg. 3712/1944. 46-year-old man. Admitted to the surgical service for hemorrhage. Billroth's first operation was done after an eight-day cure and revealed a penetrating duodenal ulcer. Discharged healed.

14. Surg. 3218/1940. 28-year-old man. Ulcer cure in 1937. Perforation in August 1940. Admitted to medical service in 1940 following

hematemesis. Severe hemorrhage. Six days later Billroth's first operation. Penetrating duodenal ulcer next to hepatic artery. Discharged healed.

C. Cases of hemorrhage from non-callous ulcer.

15. Surg. 3833/1941. 48-year-old woman. Repeated gastric hemorrhage for nine years. Cure in 1940: deformity of the duodenal bulb and severe gastritis. When the patient was again admitted in 1941 for protracted hemorrhage and with a serum protein level below 5 mg percent, the internists considered that operation was vitally indicated despite the absence of a roentgenologic niche. The serum protein was raised to 7 mg percent by transfusions. Billroth's first operation was performed, revealing a small ulcer in the mucosa on the anterior aspect of the duodenal bulb. There was heavy bleeding from the margins of the wound. Microscopically there was an ulceration in the muscularis mucosae corresponding to the ulcer. Advanced chronic gastritis with acute irritation was present. Discharged healed.

16. Surg. 3396/1942. 28-year-old man. Ulcer cure two years previously for duodenal niche. Admitted to the medical service for hemorrhage. During the cure there was constant bleeding, and progressive anemia developed despite repeated transfusions. The internists therefore considered the condition hopeless and requested operation despite the absence of a roentgenologic niche. Billroth's second operation revealed a superficial pyloric ulcer. Discharged healed.

17. Surg. 1363/1943. 30-year-old man. Perforation in 1939. Treated in the medical service in 1942 for hemorrhage. Readmitted to the surgical service from another hospital in 1943 for severe hemorrhage. Billroth's first operation. Several small areas of erosion in mucosa. Discharged healed.

18. Surg. 3802/1943. 29-year-old woman with duodenal ulcer. Admitted to the medical service for severe hemorrhage and shock. Hemorrhage continued during cure. Progressive anemia. Billroth's first operation revealed a superficial duodenal ulcer in the anterior wall. Discharged healed.

19. Surg. 1265/1944. 24-year-old man referred from the medical service for operation on vital indications following a cure with several transfusions. Billroth's second operation was done, revealing a duodenal ulcer. Discharged healed.

Summary.

A report is given on 539 cases of manifest hemorrhage due to ulcer treated during the years 1929 to 1945 at the medical and surgical services in Örebro, Sweden. These cases are divided into two groups according to the principles of treatment. The second group, covering the years 1939 onward, includes the cases of hemorrhage which from the outset were put on a diet of strained

food (about 2,500 calories daily) as well as abundant water. Roentgen examination was done as soon as possible and was not attended by any difficulty or risk. It yielded accurate information as to the presence or absence of callous ulcer in more than 90 percent of the cases examined.

In the treatment of shock large transfusions of blood, plasma, serum or dextran were given. A careful check was kept on the fluid balance with a view to the protein level and to acidosis and alkalosis. The question of operation was decided by a surgeon and an internist in consultation on the basis of the following indications:

1. Chronic ulcer with a roentgenologic niche; ulcer diagnosed definitely at an earlier date; perforation, with either repeated periodic hemorrhages during a cure or severe anemia with continual hemorrhage and hypoproteinemia, particularly in patients over 40 years.

2. Hemorrhage or progressive severe anemia, on which repeated transfusions and a high-caloric diet have had no effect.

Operation was considered contraindicated in both groups in the presence of advanced age and senility, severe circulatory disturbances, or serious complicating diseases.

The results of early treatment with diet and fluids as applied in the second period compare with those of the first period as follows:

The operative rate decreased from 45 percent to 7 percent of the total;

the total mortality decreased from 9.1 percent to 5.1 percent;

the mortality for cases treated internally decreased from 6 percent to 5 percent;

the postoperative mortality decreased from 13 percent to 5.2 percent.

Operation should be done as soon as possible after shock has been relieved, and its aim is to prevent further hemorrhage. Palliative measures are valueless; in 17 of 18 cases resection was done according to Billroth's first or second method. The author is of the opinion that the danger of further hemorrhage is greater than that of immediate operation.

The cause of death in the cases operated on earlier was shock in 50 percent and sutural insufficiency and secondary peritonitis in 50 percent. Both complications were suppressed in the second period by more effective shock treatment and by control of hy-

poproteinemia, which, particularly after hemorrhage, requires numerous large transfusions, as well as abundant protein administered by mouth, and which in the author's opinion is one of the main causes of sutural insufficiency.

Surgeon and internist together should shoulder the responsibility for the therapeutic results and agree as to the indications for surgery and the most suitable time for the operation. Surveys of the results obtained by the two services working together are interesting. A direct comparison between medical and surgical material would be misleading.

The study is accompanied by brief histories of the operated cases and reports on the fatal cases to illustrate the indications and contraindications for operation.

There was one death among 19 operated cases. Possibly one of the deaths among the non-operated cases might have been averted by operation, but not the others. All cases of hemorrhage were included, even if the bleeding in itself was not the sole or a contributory cause of death.

Zusammenfassung.

Verf. referiert 539 Fälle von manifester Ulkusblutung, die in der Zeitspanne 1929—1945 in der Inneren und der Chirurgischen Abteilung in Örebro in Pflege waren. Er teilt sie im Hinblick auf die Behandlungsprinzipien in zwei Serien ein. In der späteren, nach 1939, haben die Blutungsfälle von Anfang an eine Brei-diät mit etwa 2,500 Kalorien sowie reichliche Mengen Flüssigkeit erhalten. Die Röntgenuntersuchung wurde baldmöglichst vorgenommen und hat keine Nachteile oder Gefahren mitsichgebracht. Sie hat hier bei über 90 % der untersuchten Fälle korrekte Auskünfte darüber gegeben, ob kallöse Geschwüre vorlagen, oder nicht.

Bei der Schockbehandlung kamen grosse Transfusionen von Blut, Plasma, Serum oder Dextran zur Verwendung. Die Flüssigkeitsbilanz wurde inbezug auf Proteine, Azidose und Alkalose sorgfältig verfolgt und behandelt. Die Operationsindikationen werden von dem Internisten und dem Chirurgen gemeinsam gestellt und sind folgende:

1. Chronische Geschwüre mit röntgenologischer Nische oder frühere sichere Ulkusdiagnose oder Perforation, entweder mit

wiederholten Intervallblutungen während der Kur oder mit schwerer Anämie mit fortgesetzter Blutung und Hypoproteinämie, besonders bei Kranken von über 40 Jahren.

2. Übrige Fälle, bei denen wiederholte Transfusionen oder eine Kur mit kalorienreicher Diät die Blutung nicht zu beeinflussen oder eine fortschreitende schwere Anämie nicht aufzuhalten vermögen.

Voraussetzung ist in beiden Fällen, dass keine ernsten Kontraindikationen, wie sehr hohes Alter und Senilität, schwere Kreislaufveränderungen oder ernstere, komplizierende Erkrankungen vorliegen.

Die Ergebnisse der frühen Behandlung mit Speise und Trank zeigen beim Vergleich mit der ersten Periode

dass die Operationsfrequenz von 45 % auf 7 % der Gesamtzahl gesunken ist,

dass die Gesamtmortalität von 9.1 % auf 5.1 % gesunken ist,

dass die Sterblichkeit intern behandelter Fälle von 6 % auf 5 % gesunken ist,

dass die postoperative Mortalität von 13 % auf 5.2 % gesunken ist.

Die Operation soll baldmöglichst nach Behebung des Schocks vorgenommen werden und bezweckt eine erneute Blutung zu verhindern. Palliative Methoden sind wertlos. In 17 Fällen von 18 wurde die Resektion nach Billroth I oder II vorgenommen. Verf. hält die Gefahr erneuter Blutung für grösser als die einer sofortigen Operation.

Die Todesursache war bei den früher operierten Fällen in 50 % Schock, in 50 % Nahtinsuffizienz und sekundäre Peritonitis. Beide sind in der späteren Periode beseitigt durch effektivere Schockbehandlung sowie durch Bekämpfung der Hypoproteinämie, die besonders nach langdauernden Blutungen zahlreiche und grosse Transfusionen und reichliche perorale Eiweisszufuhr erfordert, und die Verf. für die wichtigste Ursache der Nahtinsuffizienz hält.

Der Chirurg und der Internist müssen die Verantwortung für die Behandlungsergebnisse gemeinsam tragen und sich über die Indikationsstellung sowie über den Zeitpunkt für den Eingriff einig werden. Von Wert sind deshalb Zusammenstellungen der von den beiden Kliniken gemeinsam erzielten Resultate. Ein direkter Vergleich des internen und des operierten Materials wird ungerecht und irreführend ausfallen.

Der Arbeit sind Krankengeschichten der operierten Fälle und ein Bericht über die Todesfälle als Illustration der Indikationen und Gegenindikationen der Operation beigelegt.

Auf 19 operierte Fälle ein Todesfall. Von den 11 Todesfällen unter den Nichtoperierten hätte einer vielleicht durch eine Operation gerettet werden können, die übrigen nicht. Die Mortalität ist unreduziert; alle Blutungsfälle wurden mit aufgenommen, auch wenn die Blutung an sich nicht die einzige oder eine beiträgende Todesursache darstellte.

Résumé.

L'auteur relate 539 cas d'hémorrhagie manifeste d'origine ulcéreuse qui ont été soignés de 1929 à 1945 dans les Divisions Médicale et Chirurgicale d'Örebro. Il les divise en deux séries d'après les principes du traitement. Dans la seconde, après 1939, les cas qui saignaient étaient mis dès le début au régime des purées, représentant environ 2,500 calories, avec administration large de liquide. L'examen radiologique a été entrepris aussi tôt que possible et ne s'est accompagné ni d'incommodité ni de risques pour le malade. Dans ces cas il a donné des renseignements corrects sur la présence ou l'absence d'un ulcère calleux chez plus de 90 % des sujets qui y furent soumis.

Pour combattre le shock on a recouru à des transfusions massives de sang, de plasma, de sérum ou de dextran. L'équilibre humoral, en ce qui concerne les protéines, l'acidose et l'alcalose a été exactement surveillé et soigné. Les indications opératoires sont posées d'un commun accord par le médecin interniste et le chirurgien et sont les suivantes:

1. Ulcères chroniques accompagnés de niche visible aux Rayons X, ou bien dont le diagnostic a été assuré précédemment, ou encore ayant présenté une perforation, avec soit des hémorrhagies répétées à intervalles pendant la cure, soit une anémie grave avec continuation du saignement et hypoprotéinémie, spécialement chez les malades au-dessus de 40 ans.

2. Les autres cas, lorsque des transfusions répétées et un traitement par un régime riche en calories ne réussissent pas à influencer l'hémorrhagie ou à arrêter les progrès d'une anémie grave.

Dans les deux circonstances il ne doit exister aucune contre-

indication sérieuse telle qu'âge avancé ou sénilité, altérations sévères du système circulatoire, ou autres complications par maladies graves.

Les résultats du traitement précoce par nourriture et boisson montrent, par comparaison avec la première période,

que le chiffre des opérations a baissé de 45 % à 7 % du nombre total,

que la mortalité globale est descendue de 9.1 % à 5.1 %,

que celle des cas traités par la méthode conservatrice a passé de 6 % à 5 %,

que la mortalité postopératoire s'est réduite de 13 % à 5.2 %.

L'opération doit avoir lieu le plus tôt possible dès que le shock a été conjuré, et viser à empêcher une nouvelle hémorrhagie. Les méthodes palliatives n'ont aucune valeur; dans 17 cas sur 18 on a pratiqué une résection selon Billroth I ou II. L'auteur considère une nouvelle hémorrhagie comme plus dangereuse que l'intervention immédiate.

La cause de la mort, dans les cas opérés antérieurement, était le shock pour 50 %, et pour 50 % l'insuffisance des sutures avec péritonite consécutive. Ces deux dangers ont été éliminés dans la seconde période en traitant plus efficacement le shock et en combattant l'hypoprotéinémie qui, surtout après des hémorrhagies de longue durée, nécessite de nombreuses et grandes transfusions associées à l'administration abondante d'albumine per os, l'hypoprotéinémie, de l'avis de l'auteur, étant la cause essentielle de l'insuffisance des sutures.

Chirurgien et interniste doivent porter ensemble la responsabilité du résultat thérapeutique et se mettre d'accord sur l'indication opératoire et le moment de l'intervention. C'est l'exposé des résultats obtenus par la collaboration des deux Services qui a de la valeur. Une comparaison directe du «matériel interniste» et du matériel opéré manque d'équité et est trompeuse.

Le travail est suivi des observations des cas où l'on est intervenu et du compte-rendu des issues mortelles, pour illustrer les indications et contre-indications opératoires.

Sur 19 cas opérés il y a eu 1 décès. L'un des 11 malades qui moururent sans intervention aurait peut-être pu être sauvé par la chirurgie, mais pas les autres. Le chiffre de la mortalité n'a pas été corrigé, tous les cas avec hémorrhagie figurent dans la statistique, même lorsque par elle-même la perte de sang n'a été ni la seule cause de la mort ni une cause adjuvante.

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Sur l'opération de la luxation habituelle du pouce.

Par

STEN VON STAPELMOHR.

La subluxation habituelle de l'articulation du pouce se présente non très rarement sous forme d'une flexion dorsale de la phalange basale et est provoquée par une hyperextension. D'autres fois, il s'agit d'une véritable luxation sur la face dorsale de la tête du I. métacarpien. On observe alors à l'hypertension que les ligaments latéraux (ligamenta collateralia) se déplacent avec un soubresaut sonore (doigt claquant), au dessus des deux tubercules qui se trouvent à la surface articulaire du métacarpien. Ainsi se produit momentanément une flexion palmaire de la phalange distale causée par un étirement passif du tendon fléchisseur. La condition de cette subluxation, provoquée volontairement, est que la partie palmaire du ligament glénoïdien soit anormalement relâchée. Ces luxations habituelles incomplètes sont provoquées par le sujet, à l'aide d'une flexion rapide de la phalange terminale, elles appartiennent souvent à ces tours de clown qui causent de l'étonnement à l'entourage.

Les luxations habituelles se présentent aussi quelquefois sans traumatisme extérieur, le sujet en question ayant dès l'enfance observé chez lui cette disposition par laquelle il différait de ses camarades, s'est amusé avec le temps à exercer sa dextérité de fléchir le pouce en arrière. Selon FERÉ (Centr. f. Chir. 1899, nr 29, p. 814), une telle luxation se montrerait souvent chez les idiots, les fous, les épileptiques. Parmi 218 cas de ce genre il a observé cette particularité dans 38 cas, dont 18 des deux côtés.

Mais outre ces luxations claquantes, il existe une forme de luxation dorsale habituelle qui apparaît au moindre mouvement et sans bruit, elle est accompagnée de malaise et de douleurs. Ce fut grâce à un cas de ce genre et qui exigeait un traitement que je fus appelé, en 1945, à étudier de plus près les luxations habituelles du pouce.

Il s'agissait d'un garçon de courses de 16 ans, (Journal nr 1036/44), qui, six mois auparavant, avait eu son pouce luxé dans l'articulation basale. Un médecin l'avait remis plusieurs fois, mais durant le dernier mois il ressortait constamment et au moindre choc de son articulation. On pouvait constater également une certaine tendance à la subluxation dans l'autre pouce.

A la radiographie du $9/1$ et du $16/2$, on n'observa aucune altération osseuse ou articulaire dans aucun des deux pouces.

Le malade fut hospitalisé le $11/2$, dans le but d'opération. Je reviendrai ultérieurement à la méthode. Il quitta l'hôpital le $6/4$ 1945, délivré de tous symptômes.

L'examen postérieur fut fait le 18 mars 1946. Le pouce n'était plus enclin à la luxation, soit passive, soit active. Il n'existait aucune diminution du pouvoir fléchisseur de l'articulation de la première phalange. Au fléchissement maximum du pouce gauche à l'intérieur de la main, on constata qu'il atteignait jusqu'à l'articulation basale du 4^e doigt. Le pouce droit atteignait jusqu'à l'espace entre le 4^e et le 5^e doigt. L'extension était semblable des deux côtés.

Le patient déclara alors que le pouce droit avait également commencé à se déboîter complètement et qu'il devait recourir à l'aide de ses camarades pour le remettre en place. Il exprima le désir d'être aussi opéré du pouce droit.

Ceci fut fait le $21/2$ 1946, et de la même manière qu'au pouce gauche. A l'examen ultérieur, pratiqué le $8/5$, on constata que le pouce était parfaitement mobile et qu'il ne montrait aucune tendance à la subluxation, soit passive, soit active.

Nous nous trouvons donc en présence d'un jeune homme atteint dès l'âge de 16 ans de luxation habituelle dans l'articulation intérieure du pouce gauche et montrant le même phénomène six mois plus tard dans le pouce droit. Le pouce gauche est opéré avec un bon résultat. On constate un an plus tard que la luxation a disparu et que la fonction du pouce est entière. On voit alors que le même phénomène s'est développé dans le pouce droit et l'on procède à une nouvelle opération, laquelle donne le même excellent résultat.

Cet état de luxations répétées demandait une thérapie. A ma connaissance il n'en existe pas dans la littérature. Il y a cependant des méthodes opératoires pour les luxations irréductibles du pouce

et généralement dans le but d'écarter les obstacles éventuels à la reposition.

Afin de pouvoir expliquer ma méthode opératoire, il me faut décrire brièvement la capsule et le ligament de l'articulation intérieure du pouce. L'hypertension du pouce dans la phalange basale, ainsi que dans les autres doigts, est limitée par une lamelle fibro-cartilagineuse: le fibrocartilage glénoïdien, lequel est situé du côté palmaire de la tête métacarpienne. Elle est le plus fortement fixée au bord de la cavité phalangienne, surtout des deux côtés. La plaque forme une sorte de lèvre sortant du côté palmaire de la cavité phalangienne. Par contre, elle est fixée très lâchement à la partie palmaire du métacarpien. Le côté palmaire de la lamelle est fixé intimement à la gaine du tendon fléchisseur. Sur les côtés, elle est fortifiée par les faisceaux phalangiens (= ligamenta collateralia) des ligaments latéraux sortants des tubercules latéraux du métacarpien dans la direction distale palmaire des parties latérales de la phalange. A un niveau plus palmaire se trouve les faisceaux glénoïdiens des ligaments latéraux (ligamenta capituli arciformia volaria), qui fixent le fibrocartilage ci-dessus nommée de la phalange à la tête du métacarpien.

Les tendons des muscles courts du pouce sont intimement réunis à l'attache du faisceau glénoïdien palmaire. Du côté radial: l'abduct. poll. brev. et un des ventres du flex. poll. brev. Du côté ulnaire: l'autre ventre du flex. poll. brev. et l'adduct. poll. brev.

En étudiant l'anatomie de la jointure basale du pouce je trouvais que les faisceaux phalangiens et les faisceaux glénoïdiens ont leur importance pour conserver la vraie position de la cavité phalangienne de la phalange basale. Le relâchement de ces ligaments amenant une tendance à la luxation. Je fis alors cette réflexion que si les courts tendons de l'abduct. poll. brev., les deux parties du flex. poll. brev. et de l'adduct. poll. brev. étaient ramenés dans un sens plus palmaire, ceci contribuerait à empêcher la luxation dorsale.

A l'opération, je pratiquai des incisions latérales du côté radial et ulnaire de la jointure basale. Je découvris les tendons et le flex. poll. brev. à l'attache de la phalange basale, ainsi que les faisceaux phalangiens et les faisceaux glénoïdiens à la capsule et du côté à l'adduct. poll. brev. et au flex. poll. brev. Je pus alors constater que les deux faisceaux phalangiens des ligaments latéraux

glissaient au dessus du tubercule des deux côtés de la tête métacarpienne et que le refoulement de ces ligaments avec les tendons du côté palmaire empêchaient la luxation. Je pratiquai un tunnel avec la sonde de Lister sous la gaine du fléchisseur, à travers le ligament vaginal. Une greffe du fascia lata fut transplanté dans le tunnel et cousu en forme de manchette serrée autour des tendons étreints sur l'attache. J'avais d'abord constaté que si l'on rapprochait les tendons mentionnées et les fixait dans cette position, on prévenait la luxation dorsale. La manchette ainsi confectionnée eut aussi le résultat de renforcer les faisceaux glénoïdiens palmaires. La plaie fut suturée. Le pouce fut maintenu en demi-flexion pendant deux semaines, à la suite desquelles on commença le traitement de mobilisation.

Le résultat des deux opérations fut vérifié, pour l'une au bout d'un an et trois mois, et pour l'autre après trois mois. Le sujet se déclara satisfait. C'est pourquoi je crois pouvoir recommander cette méthode.

Résumé.

L'auteur décrit une nouvelle méthode opératoire pour les luxations habituelles de l'articulation interne du pouce, deux fois établie avec succès. Elle consiste à étreindre les tendons de l'abduct. poil. brev., du flex. poll. brev. et de l'adduct. poll. brev. à travers le ligament vaginal sous la tête métacarpienne, à l'aide d'une manchette faite d'une greffe du fascia lata. Ainsi se forme un renforcement du faisceau glénoïdien du ligament latéral.

Summary.

The author describes a new surgical method for treating habitual dislocations of the proximal phalanx of the thumb, carried out successfully 2 times. After incisions radial and ulnar nearly to the basal joint one pushes the tendons of abduct., flexor. and adduct. pollic. brev. together near the attachments on the phalanx below the head of os metacarp. I. For this is a graft taken from the fascia lata and entoured like a manschette through the lig. vaginale and round the mentioned tendons. A reinforcement of the lig. capituli arciforme volare is in this way also established.

Zusammenfassung.

Verf. teilt eine neue Operationsmethode für die habituellen Daumenverrenkungen mit, die 2-mal mit ausgezeichnetem Resultat gemacht ist. Nach seitlichen, ulnaren und radialen Incisionen in der Höhe des Grundgelenkes werden die Sehnen der abduct., flexor. und adduct. pollic. breves freigelegt und durch einer Manchette von frei transplanterter Faszia lata durch dem lig. vaginal. zusammengedrängt. Dadurch wird auch eine Verstärkung des lig. capituli arciforme volare etabliert.

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From the Usserød Sygehus.
(Chief: Ch. E. HINDBORG),
and the Frederiksborg Amts Centralsygehus, Otolaryngologic Dep.
(Chief: KARSTEN KETTEL, M. D.).

Treatment of Oesophageal Varices by Injections of Sclerosing Agents through Oesophagoscope in Splenectomized Patient Suffering from Splenic Phlebo- stenosis (Splenic Anaemia). A Case with Autopsy.

By

ELLI TROLLE and DYRE TROLLE.

The patient whose case is described in this paper was admitted to the Usserød Sygehus in 1940. This patient presented the following symptom triad: Repeated, severe, gastro-enteric haemorrhages, variations in the size of the spleen, and blood changes (anaemia, leukopenia, and thrombopenia). A diagnosis of splenic phlebostenosis was made. The varying spleen size is, according to WALLGREN (1927), pathognomonic of this disease, although the sign is not always present. BRANDBERG (1935) claims further that there must be no cirrhosis of the liver. And, as appears from the autopsy, our patient presented no cirrhosis.

The etiology of this disease is very doubtful, and it is a question whether the splenic phlebostenosis is a disease *sui generis*. It is at any rate beyond all doubt that also other forms of splenomegaly may, at least at their final stages, lead to the same triad; and many writers adhere to the names of splenic anaemia or Banti's syndrome for these diseases.

Since the case observed by us does not enable us to contribute to a solution of the etiology, we shall refer to other writers for information both on this question and on histologic examinations and the clinical signs of the disease (*e. g.* WALLGREN 1927, MCNEE 1931, 1938, BRUGSCH 1933, BRANDBERG 1935, JAEGER 1937, BERDAL & HVAL 1938, NEWMANN 1938, THOMPSON 1940).

The question to be dealt with in this article is that of the *therapy*. No causal treatment can be given as yet, since the etiology is unknown.

The haemorrhage is the most outstanding sign, and generally the one that causes the death of the patient. We should therefore in the first instance set in against this sign. The clinical observations: a slowly increasing spleen -- haemorrhage coming on suddenly and followed immediately by a decrease in the size of the enlarged spleen, are highly suggestive that the spleen should be the centre of these haemorrhages.

Splenectomy is therefore a very natural operation, and an operation which should in advance be thought to be rational, because it seems to set in against all the symptoms of the triad, since the blood changes may be regarded as a splenogenic bone marrow inhibition.

X-ray treatment of the spleen is another possibility. This treatment is, however, said to have no effect (BRUGSCH, 1933). As, moreover, one always runs the risk of injuring the bone marrow, this treatment should be forborne.

Splenectomy is for the time being the method of treatment most often applied. It is, however, difficult to pronounce on the effect, because the periods of observation have been far too short in most of the cases. Yet the results seem to be most favourable in the cases of children and young adults, both as regards the primary operation mortality and the subsequent results. Thus for instance out of BRANDBERG's 29 patients (11 under 16 years of age) 12 (3) died in connection with the operation, 8 (3) died of symptoms of recurrence, 1 from a different cause, and 8 (5) were alive and well from 2 to 14 years after the operation.

The operation itself may also in some cases give rise to haemorrhage, since such may be brought about by the manipulations with the spleen (TONSETH, 1933).

The splenectomized patients are, however, by no means safe against fresh haemorrhages. A number of cases have been reported (a. o. by PEMBERTON 1931, BRANDBERG 1935, ROUSSELOI 1936, CRAFOORD & FRENCKNER 1939, MOERSCH 1940, SKOOG 1942) in which haemorrhages recurred several years after the operation, in some cases even so severe that they resulted in death.

To be able to explain these haemorrhages we must realize that the submucous venous plexus round the cardiac part of the oesophagus has 3 ways of communication, viz. 1) with the portal vein

by the vena coronaria ventriculi, 2) with the spleen by the venae gastricae breves, and 3) with the vena cava superior by the vena azygos (KEGARIES 1933, 1934). The splenectomy obstructs way No. 2, but the two others as well as the varices persist (KEMR, 1938).

Various supplementary operations have been thought out in order to avoid these haemorrhages. Thus PEMBERTON (1931) proposes to complete the operation by ligating the vena coronaria ventriculi after the splenectomy has been done, and to finish up the operation by doing omentopexy. WALTERS (1933) recommends injection of a sclerosing agent into the oesophageal varices. MAINGOT (1938) adheres to PEMBERTON's method, but recommends in addition injection of sodium morrhuate into the vena coronaria ventriculi. We cannot, however, judge of the methods used by these writers, because the periods of observation were too short in all their cases.

CRAFOORD & FRENCKNER (1939) pursued a different course. First they did splenectomy. As, however, haemorrhages recurred after scarcely 2 years, C. got the idea of injecting quinine-urethane into the oesophageal varices through an oesophagoscope. These injections were given every other day for a whole month, and each time into 3 or 4 varices. The same method was applied with success by MOERSCH in 1940 in a case corresponding exactly to the former; and 4 more such cases were reported that same year by WALTERS, MOERSCH, & MCKINNON. A 2.5 per cent solution of sodium morrhuate (fatty acid extracted from fish liver) was applied in all these 5 cases. The periods of observation were in these cases less than 6 months. (In a 6th case the treatment of injections had to be given up, because it resulted in a profuse haemorrhage, which necessitated a compact, intraoesophageal tamponade).

The same idea occurred to us in the *Ussered Sygchus* before we knew CRAFOORD & FRENCKNER's and WALTERS, MOERSCH, & MCKINNON's papers on this subject. Our consulting pharyngologist (Dr. KETTEL) entered immediately upon the idea and constructed the necessary apparatus. After the first injection had been given we realized, through SKOOG's report in 1942, that this method had been published already 3 years previously.

Finally the oesophageal varices may be submitted to direct operation, as they may be excised transpleurally or transperitoneally (quoted after CRAFOORD & FRENCKNER).

The case history of our patient will only be rendered in brief:

A man aged 24, who had previously been in good health, experienced in April 1940 a very profuse gastro-enteric haemorrhage, which came on suddenly. This recurred 3 times at intervals of 7, 5, and 5 months respectively. He was operated on in October 1941 on a mistaken diagnosis of ulcer. A splenomegaly was ascertained during the operation (no ascites, the liver was normal). Further examinations were made then (a. o. roentgenologic establishment of oesophageal varices) and the case history was revised, after which a diagnosis of *splenic phlebotenosis* was made on the basis of the characteristic triad. Splenectomy was decided on, but the operation had to be postponed on account of another profuse haemorrhage in November 1941, 2 months after the first one (1860 cc. of blood were vomited in the course of 6 hours). *Splenectomy* was done (by Dr. HINDBORG) in December 1941. The removed spleen weighed 1250 gm. Microscopy revealed fibrosplenia and a slight stasis (signed HARALD GORMSEN). After this operation the patient felt well for 7 months, until June 1942, when again he had an attack of copious gastro-enteric haemorrhage (2700 cc. of blood were vomited in the course of 24 hours).

Laparotomy was done again in August 1942 for the purpose of ligating the vena coronaria ventriculi and injecting a sclerosing agent into the varices. The operation had to be given up, however, on account of adhesions (such adhesions should as a matter of fact be regarded as advantageous, cf. the above remarks on omentopexy).

The previously considered idea of injections into the oesophageal varices through an oesophagoscope, which had been given up again, because nothing had been found in literature on its application, was now reconsidered. As we found no other means to help our patient we applied to Dr. KETTEL, who at once entered upon our idea and constructed the necessary apparatus (a Drøll-syringe and a vein-cut cannula connected by a 50 cm. long middle piece, on to which the cannula was screwed.)

In September 1942 the first *oesophagoscopy with injection into the oesophageal varices* was done in the Usserød Sygehus (Dr. KETTEL). The operation was carried out in local cocaine (10 per cent) anaesthesia. The lower half of the oesophagus, particularly the anterior wall and the left lateral wall in the direction towards the cardia, presented thin-walled, bluish-pellucid varices. The latter were punctured in 3 places and 2 cc. of Varex (Lundbeck & Co.) were injected in each place. This substance consisted in 0.15 gm. mono-aethanol-amino-oleate, 0.10 gm. benzyl alcohol, and 3 cc. of distilled and sterilized water. The course was quite uncomplicated, apart from a little expectoration of bloody mucus for the first few hours after the operation.

Another oesophagoscopy was carried out well over 2 months later. The previously injected varices had shrunk essentially, appearing now as pea-sized intumescences along the left border of the oesophagus. Fairly large varices were still seen anteriorly. A total of 8 cc. of Varex were injected into a number of these latter varices.

All the subsequent injections were given in the Frederiksborg Amts Centralsygehus. The patient was in this hospital 1) from Dec. 7, 1942 to Jan. 5, 1943, 2) from Apr. 5 to May 16 1943, and 3) from Oct. 26 to Dec. 1, 1943. Oesophagoscopy was undertaken 5, 6, and 4 times respectively, each time with injections of from 2 to 5 cc. of Varex into the varices. The varices seemed gradually to decrease in size. The injections were often accompanied by a little pain in the back, which might sometimes persist for up to 24 hours. Slight bleeding was occasionally observed from the point of injection; but such bleedings would always cease promptly and spontaneously. The injections were never followed by haematemesis.

On Apr. 14, 1944 the patient, who had been feeling perfectly well since the commencement of the injections, was again seized with a violent attack of haematemesis, and again no releasing factor could be ascertained. He was admitted at once to the Frederiksborg Amts Centralsygehus, where he stayed till July 17, 1944. Transfusion of blood (500 cc.) was undertaken as a prophylactic measure, after which no haematemeses. A few of the remaining varices were injected on May 24, and again on May 30. The latter operation had to be stopped, however, on account of coughing. No other complications. Subsequently 7 more injections were given.

During his next stay in hospital, from Sept. 8 to Nov. 13, 1944, 2 injections were given.

Last stay, from Febr. 19 to March 31, 1945: The varices seemed on oesophagoscopy to have become greatly reduced. A total of 4 injections were given during this stay.

The patient committed suicide in April 1945, partly for private reasons and partly on account of disappointment of the recurring haemorrhages in spite of the different treatments instituted.

Summary of the patient's condition after the commencement of injections into the oesophageal varices:

1. A total of 32 injections of from 1 to 8 cc. of Varex each were given in the course of 30 months (the last time only did we apply 1 cc. of quinine hydrochloride with 10 per cent urethane).

These injections were supposed to transform the varices into larger or smaller connective-tissue nodes.

2. A comparison between the skiagrams of the oesophagus taken by a contrast medium before the commencement of the injections and during the progress of the latter over a period of 30 months shows the varices to have decreased but little in size. The difference is not so striking as the one observed by oesophagoscopy (apparently this need not be the case either, because it is impossible in the skiagrams to distinguish between proper varices and connective-tissue nodes after obliterated varices).

3. The injections into the varices were commenced 3 months

after the 6th gastro-enteric haemorrhage (and 9 months after the splenectomy). The patient felt perfectly well after the first injections and had no haemorrhages for 19 months. Then another similar attack of haematemesis. The injections were continued, and now no haemorrhage occurred until he committed suicide 12 months later.

(The total number of gastro-enteric haemorrhages and the intervals in months between the latter appear from the following table:

h	—	7	—	h	—	5	—	h	—	5	—	h	—	2	—	h	—	7	—	h	—	19	—	h	—	12	—	suicide
																spl.												

where h means haemorrhage and spl. the point of time of splenectomy).

That the severe haemorrhages ceased almost entirely must, from the course of the disease and the clinical finding, be supposed to be due to the injections having obliterated the large, oesophageal venous plexus. This hypothesis is borne out by the small number of cases already reported in literature (CRAFOORD & FRENCKNER, and MOERSCH et al.). Indeed, no autopsy was undertaken in any of these cases.

The more surprising are our postmortem findings:¹

The *oesophagus* presents macroscopically a great number of longitudinal folds, which in the lower one-third are unequal in thickness and dark, as is generally seen where moderate varices are found. No fibrous cords palpable in the mucous membrane. No ulcerations.

A great number of cross-sections, cut from the entire length of the oesophagus, show microscopically (especially in the part bordering on the cardia) moderately to greatly dilated veins, which generally lie close together. The great majority of these dilated veins are situated in the submucosa, and in some places they cause the mucous membrane to bulge out. The walls of the veins are from moderately thick to thin, and of a normal structure; more particularly there is found neither diffuse connective tissue development, pad-like thickening of the intima, nor round-cell infiltration. The lumen is filled with copious amounts of blood, but no thrombosis is found, neither fresh nor older. No fibrous cords have been demonstrable among the varicosely changed veins after total organisation of thrombosed veins. No cicatrices nor ulcerations. Peripherally the oesophageal wall presents several transversely

¹ Unfortunately the postmortem examination has been deficient. The evisceration was done in the Usserød Sygehus, while a closer examination was made in Copenhagen. Owing to unfortunate circumstances the sending took 3 days; the not very carefully fixed organs had therefore undergone considerable cadaverous changes on their arrival.

extended tracts of black-pigmented, wandering-cell-like elements, which are unequal in size. In supplementary sections such pigmentation is seen also in the submucosa. The pigmentation is limited almost exclusively to the central sections.

The *ventricle* presents no definite changes macroscopically. Also the *intestinal canal* is normal.

The *liver* is normal of size, shape, and colour. The surface is slightly chagrined or granulated in several places, particularly so infero-anteriorly and along the borders. The consistence of the tissue very slightly increased. The cut surface presents no cirrhosis marking. Portal veins and biliary duct normal.

Microscopically the liver cells are found to be natural and the structure is normal in all great essentials. The tissue presents some hyperaemia and slight brown pigmentation. Slight connective tissue proliferation accompanied by a little round-cell infiltration is seen scattered periportally. No structures characteristic of Laennec's cirrhosis. The vessels are normal.

The *pancreas* is normal. The caudal area is somewhat frayed, so accordingly the *splenic vessels* cannot be demonstrated with any certainty.

Microscopically the cauda pancreatis area is seen to be somewhat frayed and to have undergone considerable cadaverous changes. The *splenic vessels*, which are situated close to the latter have been obliterated almost in their entire lengths by compact connective tissue masses poor in cells.

Heart, aorta, lungs, kidneys, and urinary duct are normal. (signed SVEND PETRI).

Thus there is a marked contrast between the clinical picture and the pathologic-anatomic findings.

The marked improvement — both in the condition of the patient and as regards the oesophageal finding — after the commencement of the injections was indicative that the majority of the varices had become obliterated and thrombosed.

The pathologico-anatomic examination overthrew this hypothesis, however, since we did not succeed — neither macroscopically nor microscopically — in finding a single obliterated or thrombosed vein, no more than any signs of recanalisation, in spite of careful and repeated examinations.

In other words the injections did not at all have the intended effect in our case. The improvement in the patient's condition must be supposed to have been due to an interaction between spontaneous remissions of the disease and the effect of the splenectomy.

Why did the treatment of the varices fail to have effect in our case? 1) Was it because the preparation of Varex is unfit for the

purpose? or 2) because it is impossible to obtain a favourable result by injections into oesophageal varices?¹

1) The active principle of Varex is a 5 per cent mono-aethanol-amino-oleate, a fatty acid ester produced synthetically. The results obtained by treating varices of the legs with this substance leave no doubt of the sclerosing power of the latter, in the strength applied (cf. reports by BIEGELEISEN 1937, GLASSER 1938, HOGERS 1939, MEYER 1937 (all quoted after WESTERBORN (1940)). BIEGELEISEN even states that this substance is the best sclerosing agent available at present. WESTERBORN himself (1940) has in more than 300 cases used the preparation of Etolein (Asa) — which chemically corresponds exactly to Varex (Lundbeck & Co) — and in all these cases obtained a very strong thrombosing effect. In addition W. has procured information on Etolein from Swedish doctors, who all had only favourable results to report.

Thus Varex seems to be very well fit for the purpose.

2) It has never been definitely proved through histologic examinations whether it is at all possible to close the oesophageal varices by injection treatment. Clinically our patient seemed likely to have been cured — or at least almost cured — of his varices; but the histologic finding showed that the treatment had had no influence whatever on the varices. CRAFOORD & FRENCKNER and MOERSCH et al. have nothing but clinical results to go upon. Those obtained in C. & F.'s case are the only ones of which we can judge further. Clinically this patient presented no haemorrhage for 3 years. This proves nothing, however, first because the patient had already been splenectomized and been free of haemorrhages for 2 years after that, and secondly because the patient was only 16 years old *i. e.* belonged to the age-class for whom the prognosis is good after splenectomy. Nor does the fact that the varices were seen in the oesophagoscope to vanish completely prove anything with certainty, since we, too, believed the varices to have disappeared on examination by oesophagoscope. But the X-ray finding seemed to leave no doubt that the injections had had the intended effect.

It must therefore be regarded as an established fact that a

¹ A third possibility, which should also be mentioned, is that the sclerosing agent may have been injected into the oesophageal lumen instead of into the varices. We think it justifiable, however, to leave this possibility out of account because all the injections were carried out by an experienced specialist under the control of the eye, so that the fluid could be seen to be injected into the varices. In addition blood was always seen to ooze out when the cannula was drawn back. It therefore seems very unlikely that all 32 injections should have failed.

favourable result is obtainable by injections into oesophageal varices.

It is, however, still an open question why the treatment failed of effect in our case.

The only possible explanation of this fact seems to be that the sclerosing agent was carried away as quickly as it was injected. But is that possible?

Well, as a matter of fact it does seem possible; for if we imagine the oesophageal varices to have developed as a collateral outflow (by the *venae gastricae breves*) from the obstructed spleen, this function must cease to exist as soon as the spleen has been excised. Then the oesophageal varices will have a chance of becoming reduced again, a possibility which depends on the elasticity of the venous walls (this may also explain why the most favourable results of splenectomy are generally obtained in the cases of children and young adults). If the varices persist this is due to a flaccid venous wall, and not to an obstructed outflow. Thus a stasis is not necessarily present in the varices. This again means that an injected sclerosing agent may easily and quickly be carried away again.

That CRAFOORD & FRENCKNER succeeded in obliterating the varices in their patient may be due to a stasis in the oesophageal varices brought about by the outflow via the *vena coronaria ventriculi* to the portal vein having been impeded (*e. g.* by the same process as obstructed the outflow from the spleen by the *vena lienalis*). The only outflow from the oesophageal varices is then by the *vena azygos*. The favourable result may, however, also be due to the possibility that the sclerosing agent was injected not only intravenously, but also paravenously.

It seems justifiable to conclude, on the basis of our case, that it is doubtful whether intravenous injections of sclerosing agents into oesophageal varices have any effect on the latter. On the other hand it is to be supposed that such an effect is obtainable by submucous, paravenous injections of substances (*e. g.* *Varex*) that do not bring about necrosis.

Summary.

A man, aged 24, who had previously been in health, got violent attacks of gastro-enteric haemorrhages coming on suddenly at intervals of 7, 5, 5, and 2 months respectively. A diagnosis of

splenic phlebostenosis was made and the spleen, which weighed 1250 gm., was excised (micr. diagn.: fibrosplenia with a light stasis), no hepatic changes, and no ascites.

Another copious gastro-enteric haemorrhage followed 7 months later. By this time the first injections of Varex (mono-aethanol-amino-oleate) were given into the oesophageal varices through oesophagoscope. Such injections were given at intervals of ab. 6 months over a period of 30 months (a total of 32 injections). The varices seemed to decrease in size under this treatment; the great majority even seemed to be entirely obliterated. The patient had one violent attack of gastro-enteric haemorrhage (19 months after the last one) within the 30 months over which the injections extended. 12 months later the patient committed suicide.

Autopsy with macro- and microscopical examinations of the oesophagus revealed numerous large oesophageal varices, and not a single sclerosed or thrombosed vein could be demonstrated; neither could recanalisation in such veins.

Thus no effect could be proved histologically of 32 sclerosing injections. This contrast is discussed, and the conclusion is drawn that it is doubtful whether intravenous injections of sclerosing agents into oesophageal varices have any effect on the latter. On the other hand it is to be supposed that such an effect can be obtained by submucous, paravenous injections of substances (e. g. Varex) that do not bring about necrosis.

Zusammenfassung.

Ein 24jähriger, bisher gesunder Mann bekommt plötzlich einsetzende, äusserst heftige Magen-Darmblutungen in Zwischenräumen von 7 bzw. 5, 5 und 2 Monaten. Auf die Diagnose Phlebostenosis splenica hin wird die 1250 gm. wiegende Milz exstirpiert (mikroskopische Diagnose: Fibrosplenie mit leichter Stauung), keine Leberveränderungen und kein Aszites.

7 Monate später erneut äusserst heftige Magen-Darmblutung. Man beginnt deshalb die Ösophagusvarizen durch das Ösophagoskop mit Varex (Monoäthanolaminooleat) zu spritzen. Dieses wird im Laufe von 30 Monaten in Serien mit etwa halbjährigen Zwischenräumen gegeben (im ganzen 32 Einspritzungen). Bei dieser Behandlung scheinen die Varizen deutlich zu verschwinden, ja, man hat fast den Eindruck, dass sie so gut wie alle obliterieren.

In den 30 Monaten, die die Varizenbehandlung dauert, kommt 1 mal eine heftige Magen-Darmblutung vor (19 Monate nach der letzten Blutung). 12 Monate nach dieser Magen-Darmblutung nimmt der Patient sich das Leben.

Sektion mit makro- und mikroskopischer Untersuchung der Speiseröhre wird vorgenommen. Hierbei stellt sich heraus, dass zahlreiche grosse Ösophagusvarizen vorliegen, und es lässt sich nicht eine einzige sklerosierte oder thrombosierte Vene nachweisen, auch keine Rekanalisation solcher Venen.

Trotz 32 sklerosierender Einspritzungen lässt sich also histologisch nichts nachweisen. Diese Unstimmigkeit wird besprochen und man kommt zu der Schlussfolgerung, dass es unsicher ist, ob man durch Einspritzung sklerosierender Substanzen in Ösophagusvarizen eine Wirkung erzielen kann. Dagegen ist zu vermuten, dass durch submuköse, paravenöse Injektionen von Substanzen, die keine Nekrose geben (z. B. Varex), solch ein Erfolg erreicht werden kann.

Résumé.

Un homme de 24 ans, autrefois bien portant, présente de violentes et soudaines hémorragies gastro-intestinales, à des intervalles respectifs de 7, 5, 5 et 2 mois. On pose le diagnostic de sténose de la veine splénique et on extirpe la rate, qui pesait 1250 gm. (diagnostic microsc.: fibrose splénique avec légère stase). Il n'y avait ni altérations du foie ni ascite.

Sept mois plus tard, nouvelle et violente hémorragie gastro-intestinale. Là-dessus, on commence un traitement par injection de Varex (monoéthanolaminooléate) dans les varices oesophagiennes, au travers du gastroscope; il est poursuivi pendant 30 mois à environ $1\frac{1}{2}$ année d'intervalle (en tout 32 injections). Pendant sa durée les varices semblent nettement disparaître; bien plus, on a presque l'impression qu'elles ont à peu près toutes été oblitérées. Au cours de ces 30 mois, il est survenu une hémorragie gastro-intestinale violente (19 mois après la dernière); 12 mois après cet accident, le malade se suicide.

Une autopsie est pratiquée, avec examen macro- et microscopique de l'oesophage. Elle montre qu'il existe de nombreuses et grandes varices oesophagiennes et l'on n'est capable de mettre en évidence aucune veine sclérosée ni thrombosée, pas plus qu'une rekanalisation de l'une d'elles.

Donc, en dépit de 32 injections sclérosantes on n'a rien pu démontrer histologiquement.

L'auteur soumet ces constatations contradictoires à une discussion et conclut qu'il n'est pas certain qu'on puisse obtenir un effet utile de l'injection intraveineuse de produits sclérosants dans des varices de l'oesophage. En revanche, il est permis de supposer qu'un résultat de ce genre puisse être atteint par des injections sous-muqueuses et paraveineuses, en s'adressant à des substances (le varex par exemple) qui ne provoquent pas de nécrose.

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Prevention of Evacuation Difficulties of the Stomach after Partial Gastrectomy.

By

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The problem of the emptying of the stomach after gastric operations has always been an important one in gastric surgery. The second case upon which a gastrojejunostomy was performed, by BILLROTH himself in 1881, succumbed to the complication which v. MIKULICZ 16 years later called "circulus vitiosus". The literature shows that the problem is still of certain importance, even if the frequency of the complication now seems to be less than before. The frequency of severe disturbances in the emptying of the stomach seems to amount to 2.5—4 % after gastrojejunostomy and partial gastrectomy of the BILLROTH II type. After gastrectomy of the BILLROTH I type disturbances of this kind seem to occur a bit more frequently. Probably 15—20 % of all deaths after gastric operations for ulcer are caused by this complication. (PERMAN.)

The difficulties in the postoperative emptying of the stomach may be of a *primary* type, occurring immediately after the operation and stopping after one or two gastric lavages. They may also be of a *secondary* type, occurring 6—12 days after the operation after an interval during which no symptoms of this kind have been noticed, or they may develop immediately after a gastric retention of the primary type.

The terminology used in literature describing complications of this kind is not always exact. Various terms are used, "circulus vitiosus", gastric atony, gastric dilatation, gastric ileus, spastic gastroenteric block, regurgitant vomiting. Since most of these

terms suggest a cause which may be difficult to prove, the term *postoperative gastric retention* will be used in this paper.

The causes of the postoperative evacuation difficulties of the stomach may be of dynamic or of mechanical kind. A combination of dynamic and mechanical causes will presumably sometimes occur. Concerning the severe disturbances of stomach emptying, of longer duration, the dynamic causes will probably play a smaller part.

The term "gastric retention" does not imply the conception that the cause of the retention is restricted to the stomach. On the contrary, the cause of the retention is more likely to be found in the upper part of the jejunum. A certain degree of oedema in the walls of the anastomosis may be present, and has also been proved to occur, but it seems improbable that this oedema might be able to obturate the lumen completely. The bile-staining of the stomach contents after gastrectomies proves that the passage through the anastomosis in these cases is open. The retrograde invagination of the jejunum into the stomach after gastrojejunostomy has been described very rarely. Furthermore this complication has not been found to occur earlier than 9 months after the operation (PERMAN) and cannot be considered a postoperative complication *sensu strictiori*. The retention of the primary type may possibly be of purely gastric origin, but the cause of the retention of the secondary type will as a rule have to be sought in the anastomotic loop or in the efferent loop of the jejunum. It is a more or less complete ileus the surgeon has to deal with. The question will then arise: Has the ileus been caused by a faulty operative technique? Is it possible to prevent a postoperative ileus?

The cases of postoperative obstruction due to incarceration of a jejunal loop between the anastomosis and the edge of the slit in the transverse mesocolon have disappeared, as a consequence of the systematic suturing of the transverse mesocolon to the stomach wall. The increasing tendency to prefer the antecolic type of gastrojejunostomy also accounts for the disappearing of this cause of postoperative obstruction. A kink on the jejunum due to peritonitic adhesions seems to play a certain part in causing evacuation difficulties. A certain degree of infection will probably always be present in the neighbourhood of the anastomosis. But the microbes of the upper part of the jejunum seem as a rule to cause a very mild kind of infection, soon conquered by the

peritoneum. Insufficiency of the sutures of the anastomosis may cause a local peritonitis. The term "insufficiency", however, should not apply to the sutures, but to the mobility of the anastomosis. The kind of suture employed is probably of small importance, but if the mobility of the anastomosis is impeded, *i. e.* if the afferent loop of the jejunum is too short to permit a free contraction and dilatation of the stomach no kind of suture will prevent a leakage.

Distension of the jejunum is also considered to be able to cause difficulties in emptying of the stomach. The distended afferent loop is then presumed to become paretic and act as a "cul de sac" receiving the gastric contents, while the efferent loop is in a state of spasm receiving very little of the gastric contents and getting no peristaltic impulses from the paretic distended afferent loop. (BRANDBERG.)

The musculature of the upper part of the jejunum is very well developed, and accordingly this part of the small intestine has a strong motor activity. When a loop of the upper part of the jejunum is exposed in the abdominal incision it will be in a certain state of contraction, have a certain tonus. This tonus will increase considerably throughout the first minutes and reach a maximum after 5—10 minutes. If two auxiliary traction sutures are put on the loop at a distance of 22 cm immediately after the loop has been exposed, the distance between the sutures will after the named space of time have decreased to 6—9 cm, due to excessive contraction of the longitudinal muscle fibres. The cause of the contraction is probably cooling of the loop, possibly also evaporation from the surface. Sometimes but not always contraction of the inner circular layer of muscle fibres occurs at the same time. The longitudinal contraction of the jejunal loop in situ in the peritoneal cavity is not constant. A certain relaxation will necessarily take place at intervals. The limits between highest degree of relaxation and highest degree of longitudinal contraction will thus be far apart. The necessity of making allowance for this when anastomosing the jejunum with the stomach seems evident.

The normal stomach is anatomically fixed at two points, the pylorus and the cardia, and its mobility must partly be of a different kind than that of the small intestine. When the continuity of the stomach is broken, *e. g.* after a partial gastrectomy of the BILLROTH II type, the potential longitudinal contraction of the stomach becomes visible, a phenomenon well known by most

surgeons who have had to perform a reoperation after a previous gastrectomy, the rest of the stomach in these cases usually being found far up under the left diaphragm.

Experimentally a considerable analogy has been proved to exist between the movements of the human small intestine and those of the small intestine of carnivora. Three different kinds of active movements have been proved to take place:

1. *The segmenting movements.* They are fundamental and the most constant. A length of the gut may be divided into a number of segments by circular contractions. A few seconds later these segments are divided by new contractions, the original contractions relaxing and the adjacent halves of neighbouring segments forming together a new segment. These movements have one effect only, to mix the contents of the gut thoroughly with the digestive fluids. The contractions are of purely myogenic origin and are unaffected by direct application of drugs. (BAYLISS and STARLING.)

2. *The pendular movements.* These are of less importance. They appear as side-to-side swaying movements of individual loops.

3. *Peristalsis.* Experiments show that genuine peristalsis does not occur when the intestine is empty. As soon as a certain amount of content is present a peristaltic wave starts. When a partial distension of the gut takes place, either experimentally or physiologically, the first thing to happen is a contraction of the longitudinal muscles, with a maximum at the place of the maximum of distension. This contraction of the longitudinal muscle fibres causes a concentration of circular muscle fibres where they are needed most. The circular contraction has in this way the optimum amount of circular fibres at its disposal. The peristaltic wave moves toward the ileocaecal valve at a speed of 2—3 cm a minute. The contraction of the longitudinal muscle fibres runs immediately ahead of the circular contraction, "preparing the way" for the latter.

The prevention of postoperative gastric retention must be considered a result of several technical measures all of which play a certain part. Not neglecting the importance of the other points in the operative technique I will stick to one technical measure which I believe is of no small significance and which is the main point of this paper. The majority of the 105 cases of partial gastrectomy included in this material have been performed according to the method of FINSTERER-HOFMEISTER, *i. e.*

retrocolic end-to-side gastrojejunostomy. The superior 1/3 of the gastric lumen was closed, while the rest of the lumen was employed for the anastomosis. The afferent loop was placed near the lesser curvature. The anastomosis was sutured in two layers. The distance from the duodenojejunal flexure to the oral part of the anastomosis was about 15 cm. No clamps were used. In 9 cases an antecolic end-to-side anastomosis had to be used because of too thick, fibrous or short transverse mesocolon.

The jejunal loop was exposed in the abdominal incision and two auxiliary traction sutures were placed on the gut, the first one about 15 cm from the duodenojejunal flexure and the second one about 22 cm further down. The loop was then left without cover for a few minutes. After 5—10 minutes the distance between the two traction sutures had usually decreased to 8—9 cm, often to 6 cm. The anastomosis was then sutured with the jejunum in this state of longitudinal contraction. In the cases of gastrectomy with retrocolic gastrojejunostomy the left edge of the slit in the transverse mesocolon was sutured to the posterior wall of the stomach before the anastomosis was performed. The right edge of the slit was sutured to the anterior stomach wall as the last stage in the operation. All operations have been performed under local anesthesia + splanchnicus anesthesia + a little ether.

This modification of the operative technique has been systematically employed in all 105 cases of partial gastrectomy included in this material. They represent all the cases of partial gastrectomy for chronic duodenal and gastric ulcer at this hospital during the last 3 years. All the operations have been performed by myself.

The material is rather small, but the frequency of evacuation difficulties seems so low that I have ventured to publish the figures.

Of all cases of partial gastrectomy there has been one death, a 40 years old male suffering from duodenal ulcer penetrating the head of the pancreas. He had a big partial gastrectomy with a retrocolic end-to-side gastrojejunostomy of the FINSTERER-HOFMEISTER type. He died of a duodenal ileus, duodenal fistula and peritonitis. 6 days after the operation a re-operation was performed. The cause of the obstruction was probably a kink on the afferent loop due to a too short distance between the duodenojejunal flexure and the oral part of the anastomosis. In this case there was no gastric retention. The patient died 16 days after the re-operation.

Table I.

Frequency of gastric lavage and amount of gastric contents after partial gastrectomy.

1. No gastric lavage after operation	69 cases
2. One gastric lavage the day after operation. No retention of gastric contents (100 cc or less)	9 cases
3. Gastric lavage the day after operation. Average amount of gastric contents 300 cc	23 cases
4 of these cases had also a gastric lavage on the second day after operation, with small amounts of gastric contents.	
4. Gastric retention during 3—6 days after operation	4 cases
	105 cases

Table II.

Gastric lavages and amounts of gastric contents in 4 cases (mentioned in table I, 4).

	Day after operation						
	1	2	3	4	5	6	7
Case nr. 1 Male 47 years Gastric ulcer	270 cc 400 cc	250 cc 280 cc	250 cc 200 cc	75 cc			
Case nr. 2 Male 63 years Gastric ulcer Diabetes	670 cc	530 cc	450 cc	75 cc			
	270 cc	600 cc 500 cc 450 cc	275 cc 260 cc	210 cc	225 cc		
Case nr. 3 Male 46 years Duodenal ulcer Postoperative hemorrhage	270 cc	1,550 cc	535 cc	210 cc	225 cc		
	400 cc 250 cc 165 cc	550 cc 250 cc 260 cc	260 cc 250 cc	80 cc	160 cc		
Case nr. 4 Male 47 years Duodenal ulcer	815 cc	1,060 cc	510 cc	80 cc	160 cc		
		725 cc	1,000 cc 900 cc	750 cc	0 cc	475 cc	0 cc
	230 cc	650 cc	750 cc	0 cc	0 cc	550 cc	0 cc
	230 cc	1,375 cc	2,650 cc	750 cc	0 cc	1,025 cc	0 cc

Summarizing the material one finds that in 105 cases of partial gastrectomy because of gastric or duodenal ulcer 4 patients had what can be called a gastric retention. The first one (case nr. 1, Table II) got a minor bronchopneumonia the day after the operation. He was treated with sulfathiazol perorally, which caused sickness and nausea. The second one (case nr. 2, Table II) was a

63 years old male with a gastric ulcer, suffering from diabetes, and not in too good general condition, operated upon because of suspicion of cancer. The third case (case nr. 3, Table II), a male 46 years old, had a heavy postoperative hemorrhage. In this case the gastric contents were practically nothing but blood.

These 3 cases had a gastrectomy with a retrocolic end-to-side gastrojejunostomy of the FINSTERER-HOFMEISTER type.

The 4th one (case nr. 4, Table II), a 47 years old male with a duodenal ulcer, had a gastrectomy with an antecolic short loop end-to-side gastrojejunostomy of the KRÖNLEIN type.

As a whole one is entitled to say that the occurrence of post-operative gastric retention of any importance is rare in this material.

During the last 3 years 12 patients have had a gastrojejunostomy because of gastric or duodenal ulcer. In 5 cases a retrocolic posterior gastrojejunostomy was performed. In 7 cases the method of O. BORCHGREVINK was employed, *i. e.* retrocolic gastrojejunostomy with the anastomosis isoperistaltically on the greater curvature. 4 of these 12 cases had a gastric retention with amounts of gastric contents of 650—1,450 cc on the day after the operation, and later no retention. In one case, a 50 years old very fat male with a thick and short transverse mesocolon, a retrocolic gastrojejunostomy on the greater curvature was performed. The immediate result did not seem satisfactory. As the patient the first two days after the operation had a severe gastric retention a reoperation was performed. A kink on the efferent jejunal loop close to the anastomosis was supposed to be the cause of the retention. An antecolic anterior gastrojejunostomy was performed. A big part of the omentum had to be removed to get space enough for the jejunal loop in front of the transverse colon. The gastric retention continued and increased and the patient died 9 days later.

The remaining cases of gastrojejunostomy had no gastric retention.

In the cases of gastrojejunostomy the technical modification with a longitudinally contracted jejunal loop has not been systematically used.

Gastric retention occurring the day after the operation and stopping after one or two gastric lavages is most probably of

purely gastric origin. It is also possible that the minor degrees of gastric retention with average daily amount of 300—600 cc and lasting a few days may be due to dynamic causes. In these cases however, it is difficult to exclude the possibility of the presence of some kind of mechanical obstacle which is overcome when the movements of the jejunum have returned to the normal state.

The emptying of the stomach depends on two factors. The first one concerns the stomach itself and is connected with the movement of the stomach and the sufficiency of the anastomosis. The vagus generally increases the tonus of the stomach and the small intestine. The tonus inhibiting impulses pass through the splanchnic nerves. A partial gastrectomy will probably injure the vagus ramifications possibly causing a decrease in stomach mobility. (PERMAN.) Anyhow, after partial gastrectomy there is very little peristalsis in the stomach, and the emptying of the stomach after partial gastrectomy must be considered to be of mainly hydrostatic nature. "Dynamic" causes of impeded stomach emptying after gastrectomy therefore seem to be restricted to the rather rare cases of genuine gastric atony.

The second factor is connected with the emptying of the upper part of the jejunum, from the oral part of the anastomosis downward. The cause of the minor postoperative gastric retention is likely to be found in a decreased mobility of this part of the small intestine, especially of the anastomotic loop. Therefore it seems logical to employ the described technical modification suturing the anastomosis. In this way the peristaltic waves in the anastomotic loop will have a maximum of circular muscle fibres for their action, which probably will improve conditions for peristalsis. When clamps are employed one clamp is usually put on the anastomotic loop immediately after the loop has been exposed in the abdominal incision. Very often the loop is stretched by the assistant to be made even and fit for suture. When this operative technique is employed the amount of circular muscle fibres at the disposal of the peristalsis in the anastomotic loop will be about one third of that available when the anastomotic loop is permitted to contract longitudinally before the anastomosis is sutured.

I believe that the described technical modification will be able to reduce the frequency of evacuation difficulties of what I named

the *primary* type. It can easily be questioned whether it will be able to reduce the frequency of or completely prevent the emptying difficulties of the *secondary* type. The possible causal connection between the two types of postoperative gastric retention can only be guesswork. But still it seems correct to give the anastomotic loop the best possible opportunity for peristalsis from the beginning.

Summary.

The author emphasises a certain point in the operative technique of partial gastrectomy. He is of the opinion that it is important that the loop of the jejunum used for the gastrojejunostomy is in a condition of longitudinal contraction when the anastomosis is performed. The consequence of this longitudinal contraction is an accumulation of circular muscle fibres in the anastomotic loop, which presumably gives the loop the best possibilities for peristalsis. By other investigators it has been proved that a contraction of the longitudinal muscle fibres of the small intestine immediately precedes the peristaltic wave, thus "preparing the way" for the latter.

This technical modification has been systematically employed in the author's material, 105 cases of partial gastrectomy because of gastric or duodenal ulcer. The frequency of postoperative gastric retention in this material is small.

Zusammenfassung.

Der Verfasser beschreibt eine Modifikation der operativen Technik der Magenresektion. Er ist der Meinung dass es von Bedeutung ist dass sich die Jejunumschlinge, die zur Anastomose verwendet wird, in einem gewissen Grade von Längskontraktion befindet. Durch diese Längskontraktion geschieht eine Konzentration von zirkulären Muskelfasern. Die Möglichkeit der Peristaltik in der Anastomosenschlinge wird in dieser Weise wahrscheinlich gebessert. Experimentelle Untersuchungen anderer Verfasser haben gezeigt dass eine Kontraktion der longitudinalen Muskelfasern unmittelbar vor der peristaltischen Welle stattfindet. Ein Maximum von zirkulärkontraktilen Muskelfasern wird in dieser Weise eben an der Stelle der peristaltischen Welle konzentriert.

Diese Technik mit einer in der Längsrichtung wohl kontrahierten Jejunumschlinge für die Anastomose ist im Material des Verfassers, 105 Fällen von Magenresektion wegen Magen- und Zwölffingerdarmgeschwürs, systematisch angewandt. Die Häufigkeit postoperativer Ventrikelretention ist gering.

Résumé.

L'auteur souligne un point spécial dans la technique opératoire de la résection gastrique. Il pense qu'il est d'importance que l'anse du jejunum, qui est employée dans l'anastomose, se trouve dans un certain état de contraction longitudinale. La conséquence de cette contraction longitudinale est une concentration d'éléments musculaires circulaires dans l'anse d'anastomose, ce qu'on suppose donne à celle-ci les meilleures possibilités pour les mouvements péristaltiques. D'autres chercheurs ont montré expérimentalement que, immédiatement avant la vague péristaltique dans l'intestin grêle, il se produit une contraction de la musculature longitudinale. Ainsi, se concentre la musculature circulaire à l'endroit où la vague péristaltique se trouve, grâce à quoi «le chemin est préparé» au mouvement péristaltique.

Cette modification technique a été systématiquement employée dans le matériel de l'auteur qui se compose de 105 cas de résection gastrique faite à cause d'ulcère gastrique ou duodénal. La fréquence d'une rétention gastrique est rare.

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Intraarticular Fractures in the Upper End of the Tibia and Lower End of the Femur.

By

TOR OLAUSSEN.

· According to HULTÉN, two main types of fracture can be distinguished in the tibial condyles. 1. Depressed fractures. 2. Splitting fractures. Mixed types are, however, common. The classification is purely anatomical according to the radiographic appearance of the fractures.

Depressed comminuted fractures are practically only seen in the lateral tibial condyle, the articular surface of which is crushed and pressed down into the spongiosa of the condyle. There may be a bowl-shaped depression on the central part of the joint surface, but usually a marginal part of the condyle is depressed and more or less widely separated. The lateral tubercle of the tibial spine is often crushed. Simultaneously with the injury to the condyle may be seen fracture through the tibial metaphysis. X-rays, not only in the usual two planes but also in oblique projections, are necessary for recognition of the lesion.

Depressed non-comminuted fractures are rare. Here the joint surface is uninjured, but the whole lateral condyle is pressed down. The dislocation is usually slight. The fracture extends from the lateral side of the tibia up into the joint through the tibial spine outside the joint surface.

In the medial condyle depressed fracture is very seldom seen to occur in the same manner as in the lateral condyle. On the other hand, there is sometimes seen in the medial condyle a compression of the spongiosa 1—2 cm. below the joint surface, which is thus depressed, but not fractured (HULTÉN).

Splitting fractures comprise the majority of the intraarticular fractures in the upper end of the tibia. The fracture usually has an approximately sagittal course, running upwards into the joint through the tibial spine or more laterally through the articular surface of the lateral tibial condyle. Downwards the fracture may take different courses. 1. It may run obliquely to the lateral side of the tibia, usually on a level with the collum fibulae, separating the whole or most of the lateral condyle. (Splitting fracture in the lateral tibial condyle). 2. It may run to the medial side of the tibia thus splitting off the medial condyle *en masse*. (Fracture splitting off the medial tibial condyle.) 3. The fracture may downwards divide into two branches, one going to the lateral and one to the medial side of the tibia, or run to a fracture through the tibial metaphysis. (Bicondylar fracture.)

In the case of splitting fractures the articular surface of the lateral tibial condyle may to a large extent be crushed and pressed down in a manner similar to that seen in depressed fractures. At times the fracture is merely a fissure, but more often there is considerable dislocation leading, in the case of splitting fractures in the lateral condyle, to a state of valgus in the knee-joint. In fractures splitting off the medial condyle where the dislocation is usually great, the medial tibial condyle preserves its normal position in relation to the medial condyle of the femur, though often tipped over to a state of valgus, while the lateral condyle of the tibia together with the crus is displaced laterally and proximally, often with concomitant outward rotation. According to the circumstances there may thus arise a state of varus or valgus in the knee-joint. The crus gets laterally displaced in relation to the femur.

Small, marginal fragments usually the size of a bean are found in both tibial condyles. Laterally in the anterior part of the lateral condyle may be seen a somewhat larger piece, broken off the edge of the condyle at the point of attachment of the tractus ileotibialis.

Coincident with fractures of the tibial condyles, fractures of the fibula are found in about $\frac{1}{3}$ of the cases, most frequently in depressed and bicondylar fractures. Fracture of the fibula is of no practical importance for prognosis and treatment.

Fractures of the intercondyloid eminence are often seen combined with condylar fracture. Fracture of the lateral tubercle may in depressed fracture of the lateral tibial condyle be the only visible change in the X-ray, as the depression on the articular surface may be so small as to be invisible in the picture. As an independent

lesion, the whole eminence is most frequently broken off and especially in front lifted up. Often there is found at the same time a fracture in the anterior intercondyloid fossa. Whether a fragment broken off here involves the attachment of the anterior crucial ligament cannot be determined from an ordinary X-ray alone.

Fractures in the lower end of the femur are much more rare than fractures in the upper end of the tibia, because the femoral condyles are more strongly built than the tibial. The fracture generally runs through the intercondyloid fossa and thus does not directly affect the joint surface. The lateral or the medial condyle may be split off, most frequently the lateral. The condyles may also be split apart from each other by the shaft of the femur. In children and young persons may be seen epiphysial fractures, sometimes only in half of the epiphysial line, with fracture downwards through the intercondyloid fossa. Fractures in the lower end of the femur often show great dislocation and are not infrequently open.

Etiology. Fractures of the knee, especially in the upper end of the tibia, are nearly always due to subluxation movements in the joint, even when a trauma affects the region of the knee directly. It is almost impossible to get reliable information as to the position and movement of the leg at the time of the accident. The patient is usually inclined to lay stress upon the direct violence to the knee.

That fractures are so much more frequently located in the lateral than in the medial condyle of the tibia is due especially to two circumstances. In the first place, there is greater incongruency between the lateral than between the medial condyles of the femur and tibia. The pressure lies upon a smaller surface. Besides, the lateral condyle of the femur has a sharp anterior margin and is more movable upon the tibial condyle than the medial femoral condyle. Secondly, the normal state of valgus in the knee joint is also a responsible factor. The knee is more easily broken in the valgus than in the varus direction.

Depressed fractures in the lateral tibial condyle are due to an abducting violence, the margin of the external femoral condyle crushing the articular surface of the lateral tibial condyle (Fender fractures in motor-car accidents). The same fracture cannot be produced experimentally in the medial tibial condyle by an adducting violence. The typical splitting fracture in the lateral tibial condyle can be experimentally produced by forced hyperextension of the knee-joint. During the compulsory supinating movement in hyperextension, the lateral femoral condyle is pressed against

the anterior intercondyloid fossa, where its sharp anterior margin splits the bone like a wedge. Some of the clinical splitting fractures are, however, probably due to an abducting violence. This must especially be assumed to be the case where there is at the same time a depression of the articular surface of the condyle. The subluxation movements leading to fractures in living persons are as a rule combined; thus, according to PALMER, abduction is usually combined with flexion and supination. It is clear that not only the fractures, but also possible attendant injuries to ligaments may vary greatly in character.

Injuries to ligaments and menisci. Injuries to the ligaments of the knee-joint, mostly rupture of the medial collateral ligament and crucial ligaments, are of decisive importance in prognosis, owing to the importance of the ligaments for the stability of the joint. It is true, as stated by HULTÉN, that pressure injuries (fractures) have a tendency to alternate with tension injuries (ligamental ruptures), but a combination of both is not uncommon. Especially in the case of minor fractures, it must be borne in mind that injuries to ligaments may be of more importance than the fracture itself.

In fractures of the knee it is difficult to diagnose rupture of ligaments. After some weeks there may be found, as sign of a rupture of the medial collateral ligament, a Stieda shadow in the X-ray, and a rupture of the anterior crucial ligament may cause an avulsion fracture in the anterior intercondyloid fossa. On examination as to the presence of abnormal mobility in the knee-joint during X-ray translumination, it may be possible to decide whether this is due solely to the fracture or also to a ligamental injury. An increase in the distance between the medial condyles of the tibia and femur during an abducting movement denotes a rupture of the medial collateral ligament. HULTÉN regards an examination of condylar fractures as incomplete without investigation of abnormal mobility during X-ray translumination. Especially in cases of minor fractures arthrography may be indicated.

Injury to the menisci frequently occurs in condylar fractures, but late symptoms as otherwise seen in meniscus injuries are practically never observed. Most common is damage to the lateral meniscus, which may be dislodged into the joint and down into the fracture. In the case of splitting fractures, it may be a hindrance to reduction, and in depressed fractures it may contribute to fill up the depression on the articular surface.

Treatment. In the case of intra-articular fractures of the knee reduction and fixation present great difficulties. Numerous investigations have shown that correction of the malposition is often unsuccessful and that the fracture heals with considerable deformity. Undoubtedly, in most cases, the function of the knee-joint turns out better than might be expected from the anatomical results, but it must be emphasized that the prospect of a satisfactory functional result may be attained most surely by good reduction and fixation of the fracture.

The possibilities of manipulations are limited. In the first place, reduction of depressed fractures can only be effected surgically. In the second place, in the case of splitting fractures reduction is often hindered by the interposition of small fragments or of the lateral meniscus. Also operative treatment, however, may offer difficulties. The usual methods adopted for fixation such as nails and screws cannot get a firm hold in the loose, fractured, condylar spongiosa and the dislocation is easily reproduced. Several authors have maintained that the best results are attained by manipulations, even if these do not succeed in reducing the deformity. The demands for good reduction and fixation have, however, in more recent years led to more frequent adoption of operative treatment. Methods of operation have also steadily improved.

Depressed fractures. Without operative reduction the depression on the joint surface will remain unaltered throughout life, will cause a state of valgus in the knee-joint and make the knee unstable with abnormal lateral mobility. In the case of slight depressions, a readjustment of the ligaments may take place. Possibly, the lateral meniscus may contribute to fill up the defect in the joint-surface. In such circumstances a slight state of valgus but a stable knee will be the result. Greater depressions usually lead to abnormal lateral mobility. It is now generally recognised that operative treatment is here necessary.

The principles of operation are clear. The depressed joint surface must be lifted up and remoulded from below by chiselling in under the surface, and the defect thus produced in the condyle must be filled up so that the articular surface is not pressed down again.

By operating shortly after the injury time is saved and immobilisation curtailed. Separated marginal fragments can be replaced and the condyle as a whole remoulded. Technically, however, an operation at this point is difficult. The joint surface is divided into several fragments, which easily may become displaced into

the joint and which are difficult to put together again. Marginal fragments with parts of the joint surface may become entirely detached. An effective support for such a fragmented surface may be impossible to secure, where the condyle is extensively crushed. If, as recommended by HULTÉN, we postpone the operation for a few weeks, the spongiosa of the condyle will be firmer and the joint surface unites to form a membrane which is easier to lift up and remould.

Only when we can inspect the joint surface and if necessary exert pressure from above is it possible to lift up and mould the damaged surface satisfactorily. Hence arthrotomy is necessary. Regard to the meniscus also renders arthrotomy desirable. The meniscus is believed to be of service for covering over and filling up the defect in the joint surface. Experience shows that there is no reason to fear locking-symptoms. On the other hand, as pointed out by STUMPFEGGER, the meniscus may grow to the fractured joint surface and thus lose its normal mobility. Thus the final rotation in the knee-joint may be restricted, which may lead to pain in the knee and ankle. VICTOR VON BAHR found such restricted final rotation in several cases, also where the meniscus had been extirpated, and believes the cause must be due to deformity of the joint surface following the fracture. It is evidently best, if possible, to preserve the lateral meniscus, and at least not extirpate it before reduction is performed and the circumstances of the case are clearer.

Material for filling up the defect in the condyle produced when the joint surface is raised, is mostly obtained by employing grafts from the diaphysis of the tibia. PALMER, who prefers to operate shortly after the injury, formerly used spongy os purum boiled in isotonic salt solution, but since 1940 has resorted to bone graft from the crest of the ileum. Marginal fragments may need fixation by screws.

HULTÉN performs arthrotomy by horizontal incision alongside the edge of the lateral tibial condyle, cuts through the tractus ileotibialis and the lateral collateral ligament, detaches the joint capsule from the tibia, thus entering the joint under the lateral meniscus. He chisels in a couple of millimetres beneath the joint surface, which is then lifted up and moulded into shape by means of an elevator inserted into the chiselled hole. The joint surface is finally supported by a bone graft from the diaphysis of the tibia driven in horizontally.

PALMER performs arthrotomy by a lateral parapatellar incision prolonged down over the tibial condyle. If the lateral meniscus is undamaged, it is divided at its fibrous, anterior attachment so that a survey of the joint surface is obtained. Access to the under side of the joint surface is gained by chiselling out a piece of bone about 1.5 cm. in diameter from the condyle near the infrapatellar ligament. Reduction is effected by an elevator while constantly watching the joint surface and, if necessary, exerting pressure on the lateral side of the condyle. The cavity is filled with a bone graft from the crest of the ileum during counter-pressure from the joint surface and from the outer side of the condyle. Finally, the piece of bone is replaced and fixed by a couple of periosteal sutures; the attachment of the meniscus, if it has been spared, is sutured and the joint is closed.

The leading principle in after-treatment ought to be: Short fixation, early mobilisation, late weight-bearing. It takes time before the reduced joint surface can bear the weight of the body, but movements in the joint should begin early to avoid stiffness. Fixation of the knee in plaster from 2 to 6 weeks is best. Weight-bearing should not be permitted until after 12 to 14 weeks.

Less severe depressed fractures which do not need operative treatment require short fixation from two to four weeks in splints or plaster. Weight-bearing is possible sooner where the joint surface has not been elevated, and may be permitted after seven to nine weeks.

Splitting fractures. Manipulations correcting valgus or varus deformity combined with traction and compression of the condyles may succeed. Manual pressure is often not enough, but hammering or instrumental compression, as with BÖHLER'S calcaneus clamp, must be resorted to. Secondary dislocation may arise on fixation with plaster cast up to the upper part of the thigh. Fixation of the fracture by hammering in nails through the condyles and then using plaster, is unreliable. MIKKELSEN had secondary dislocation in three out of four operated cases. LANDELIUS has proposed a simple and reliable method of reduction and fixation. Reduction is attempted on a traction table. Keeping the traction, an incision is made on the medial and lateral sides of the condyles, after which they are bored through transversely. A double, metal wire is passed through the hole and secured on the lateral side by a small splinter of bone. By pulling the wire combined with manual pressure and hammering, the fragments are brought into the correct position.

The wire is secured on the medial side in the same way as on the lateral. The joint is not opened. This firm fixation ensures early mobilisation of the knee-joint. The method is not practicable in the case of comminute fractures. A metal bolt may be used in place of wire (WEBB, KILÆR). The bolt is passed transversely through the condyles through a bored hole and provided with end-plates, which come to rest on the surface of the bone on the medial and lateral sides, after which the condyles are screwed together and fixed with a nut.

Prognosis. Experience gathered during the past 10 to 15 years has shown that the prognosis of intra-articular fractures of the knee is much better than formerly supposed. In spite of considerable anatomical deviations from the normal, good function of the knee-joint is surprisingly common. A state of valgus or varus is often met with, but as long as the knee is stable, this seems to be of minor importance. The knee seldom gets stiff. Bad functional results are generally due to the knee becoming unstable, especially with abnormal lateral mobility, which is possibly at times due to damage to ligaments rather than to the actual fracture. Complaints of weak knees that give way, knees that are difficult to guide etc. are more common than direct complaints of pain. BÖHLER states that damage to the axis of the knee may give rise to a painful arthritis, which gets worse through the years, more and more restricting the mobility of the joint. In contrast, MIKKELSEN's, HULTÉN's and KOCH's researches show that arthrosis deformans was very rare after intra-articular fractures of the knee. Even injured persons, who for years had suffered from unstable knees with great lateral mobility, presented no signs of arthrosis and on the whole no progression of the ailment. HULTÉN, especially, says that restitution after fracture of the knee-joint takes a long time. The function is in the main established after a year, but the patient not unusually states that improvement has taken as much as three to four years. Abnormal lateral mobility can in time be remedied, now and then it may completely disappear. Especially is to be noted, that a slight degree of lateral mobility immediately after removal of the plaster cast need not have any serious prognostic significance.

On re-examination of 126 patients with fracture of the upper end of the tibia MIKKELSEN found 90 % quite capable of work in their previous occupations, 54 % were completely restored to health, 89 % were at work one year after the accident. HULTÉN found

good results in 24 cases, fairly good in 8 and bad in 3 cases. Normal anatomical conditions were hardly attained in any of the cases. KOCH found on re-examination of 112 patients only 8 % with bad results.

Taking each single fracture type into consideration, it is generally agreed that unreduced severe depressed fractures have a bad prognosis. Out of 9 non-operated depressed fractures HULTÉN found good results in five cases, fairly good in three and bad in one case. In the five with good results there were depressions of about $\frac{1}{2}$ cm. Both in the one case with a bad result and in the three with fairly good, abnormal lateral mobility was present. These cases involved depressions of from 2 to 3 cm., once, however, only 3 to 4 mm. In the latter case, a Stieda shadow was revealed on the radiograph as evidence of injury to the medial collateral ligament. CUBBINS and associates announced in 1934 about 50 operated cases of depressed fracture with good results. In spite of accurate reduction, some of the cases were found with a slight state of valgus in the knee-joint. Flexion was restricted in some. VICTOR VON BAHR examined 24 operated cases from PALMER's clinic. In three cases ankylosis developed. Abnormal lateral mobility was absent in all. Flexion was in most cases restricted, but usually satisfactory. The results are considered good in 16 cases, fairly good in five and bad in three, and were dependent on the reduction.

In splitting fractures the ones splitting off the medial condyle of the tibia have less good prognosis than those in the lateral. In HULTÉN's material we read of 7 splitting fractures in the lateral tibial condyle with good results, while five fractures splitting off the medial condyle showed good results in three cases and fairly good in two. Bicondylar fractures differ greatly in respect to dislocation and deformity of the joint. HULTÉN found good results in six cases out of ten, fairly good in two and bad in two.

Own Material.

In Drammen Hospital, Surgical dept., were treated 59 intra-articular fractures of the knee-joint in the 10-year period from 1/1/31 to 1/1/41 comprising 51 fractures in the upper end of the tibia and 8 in the lower end of the femur. From 1931 to 1937 inclusively there were 2 to 5 cases per annum, in 1938 seven, in 1939 thirteen and in 1940 eleven cases, thus showing an obvious increase

over the past years. Of the injured 33 were males, 26 females. The distribution among the different groups of fractures was as follows:

		♂	♀
Fractures in the lateral tibial condyle	19	10	9
Fractures splitting off the medial tibial condyle . .	7	2	5
Bicondylar fractures	13	8	5
Marginal fractures	6	4	2
Fractures of the intercondyloid eminence	6	3	3
Fractures of the femoral condyles	8	6	2
	59	33	26

The fractures in the lateral tibial condyle are distributed as follows:

Depressed comminuted fractures	9
Depressed comminuted fractures + fractures of the tibial metaphysis	5
Depressed non-comminuted fractures	2
Splitting fractures	3

The age distribution was fairly uniform. One fourth of the patients were under 30 years of age and about equally many over 60. The largest number were in the age-group from 30 to 60 years. KOCH found 31 % of the fractures in persons under 30 and 15 % over 60. 54 % occurred in persons aged from 30 to 60. MIKKELSEN found 22 % over 60 years of age. Fracture of the tibial condyles is rare before the age of 20. On the other hand, fracture of the tibial spine is most common in young persons. KOCH found half of the patients with fracture of the tibial spine under 20 years of age, and in this age-group these fractures constituted about half of all fractures in the upper end of the tibia.

Etiology. Hospital records offered little help towards the study of the mechanism of the fractures. The commonest causes were motor-car collisions, bicycle accidents, falls when ski-ing, walking or running, falls down stairs or from a height and heavy loads falling on the leg. Half of the fractures were due to traffic accidents and sports injuries. There was no definite correlation between the different types of fractures and the accidents that caused them, nor could such correlation be expected, as it is the position and movement of the leg at the moment of the accident that determines the character of the lesion. Motor-car collisions, where the fender of the car struck the lateral side of the knee-joint, were in three cases recorded as being the cause of depressed fracture in the lateral

condyle of the tibia. Fracture of the tibial spine was four times due to falls when ski-ing. KOCH found that this fracture was in nearly two thirds of the cases due to a bicycle fall. KOCH explains the mechanism in the following manner: Whilst falling the patient stretches out his leg, the foot strikes the ground with flexed knee, whereby a rotation movement in the knee-joint is produced.

In 10 cases fracture of the collum or capitulum fibulae was seen, 3 times in depressed fractures, all accompanied by fracture of the tibial metaphysis, and 7 times in bicondylar fractures. HULTÉN found fracture of the fibula more frequently in depressed fractures than in unicondylar splitting fractures. Six patients, all of whom were men under 50 years of age, had other lesions in addition to the fractures of the knee, namely: Fractura humeri, fractura columnae, coxae and luxatio humeri, fractura cruris, fractura femoris and radii and two had concussion of the brain. In 3 cases the fracture was open, once in the upper end of the tibia and twice in the lower end of the femur.

Depressed comminuted fractures. In 5 cases there was besides depressed fracture in the lateral tibial condyle also fracture of the tibial metaphysis. This latter showed little or no dislocation, a small angulation and slight lateral displacement. The depression in the articular surface of the lateral tibial condyle was in most of these cases greater than in the purely depressed fractures. The joint surface was pressed down $\frac{1}{2}$ —2 cm. Once occurred a comminute fracture of the whole lateral tibial condyle.

In the purely depressed fractures there were in 3 cases only small depressions of some few millimetres. In three instances the depression was about $\frac{1}{2}$ cm. and in three about 1 cm. deep. Three times there was seen fracture of the lateral tubercle of the tibial spine.

Depressed non-comminuted fractures. Only in one case was the lateral tibial condyle seen slightly depressed.

Splitting fractures in the lateral tibial condyle. The lateral condyle of the tibia was in all three cases separated by a fracture immediately lateral to the tibial spine, the lateral tubercle of which in two instances was found to be crushed. The condylar fragment was displaced laterally and distally and there was a state of valgus in the knee-joint. X-rays in one case revealed a Stieda's fracture 4 × 20 mm in size.

Fractures splitting off the medial tibial condyle. The fracture ran up into the knee-joint immediately lateral to the tibial spine or

through it. The nearest part of the joint surface of the lateral tibial condyle had been fractured in three cases and pressed down into the spongiosa of the condyle in the same way as in depressed fractures. In one case the posterior margin of the medial tibial condyle was separated. In two cases the fracture was merely a fissure, otherwise the dislocation was considerable, the medial condyle of the tibia being tipped over in a state of valgus and the lateral tibial condyle together with the crus displaced upwards and laterally with more or less outward rotation.

Bicondylar fractures. These fractures were rather heterogeneous. Common to them all was the vertical fracture line up through or immediately lateral to the intercondyloid eminence combined with fracture through the tibial metaphysis. In 6 cases there were transverse fractures, in three oblique fractures, in three comminuted fractures and in one case a Y-shaped fracture. Only in five cases was there considerable dislocation. Often the fracture was merely a fissure. In two cases the lateral half of the external tibial condyle was separated. The fracture in the tibial metaphysis most frequently showed moderate dislocation, a slight angulation and lateral displacement. Only in one case was there lateral displacement of the bone throughout its whole breadth without contact between the fractured ends.

Marginal fractures. In 3 cases the fracture was in the medial and in three in the lateral condyle of the tibia. In one case a somewhat larger fragment was separated antero-laterally on the external condyle at the attachment of the tractus ileo-tibialis. Otherwise the fragments were the size of a bean or somewhat larger. One patient had a fracture of the shaft of the femur on the same side as the knee injury.

Fractures of the intercondyloid eminence. As far as could be judged from the X-rays, the whole eminence was loosened at the base and there was no doubt a fracture in the anterior intercondyloid fossa in front of the eminence. There was no evidence of damage to the crucial ligaments.

Fractures of the femoral condyles. In two cases the femoral condyles were forced apart from each other by the shaft of the femur and in 4 cases the lateral and in one case the medial femoral condyle was split off. In one case there was an epiphyseolysis without dislocation. Only in 2 cases did the fracture go through the articular surface of the condyle itself, otherwise through the intercondyloid fossa. In two cases the fracture was open.

Treatment. With some few exceptions, the patients were admitted to hospital shortly after the injury was sustained. A man, aged 38, with bicondylar fracture of the tibia was not admitted until after 3 months. He had been confined to bed at home with thrombosis in both legs and several pulmonary embolisms and on admission was stiff in both knees and hips so that he could not sit up in bed. He was treated by massage and mobilisation. On discharge after 5 weeks he could flex the injured knee some few degrees. Several of the patients with fracture of the tibial spine were also admitted several weeks after the injury, one of them nearly 6 months later. Apart from the last-mentioned, they soon became free of symptoms after some weeks' immobilisation in a plaster cast.

A boy aged 11 with open bicondylar fracture in the lower end of the femur finally had to have the leg amputated at the thigh on account of infection. In the case of a man aged 41 with open fracture of the lateral femoral condyle, a usual revision of the wound was carried out. Otherwise operative treatment was employed only in three cases, all being splitting fractures in the upper end of the tibia and in all cases arthrotomy was performed.

1. A man, aged 26, with splitting fracture in the lat. tibial condyle. Arthrotomy by lateral parapatellary incision. The lateral fragment was fixed and could not be brought into position. The patient was further treated with plaster.

2. A woman, aged 64, with fracture splitting off the medial tibial condyle. On arthrotomy was found a fracture 1 cm. in width directly lateral to the intercondyloid eminence. The anterior crucial ligament together with a small piece of bone was avulsed from its attachment to the tibia. Reduction was successfully accomplished. The injury to the anterior crucial ligament was not repaired. To hold the fracture in position a Kirschner's clamp was applied so that the condyles were pressed together. Calcaneus traction and posterior plaster splint were applied. The position at the seat of fracture was well maintained. She got the leg free after six weeks, and could put weight on it after 12 weeks.

3. A woman, aged 65, with bicondylar fracture. On arthrotomy the anterior crucial ligament was found torn across and the anterior meniscus loosened and lifted up. Reduction failed. The joint was closed and plaster applied on the extended knee. X-ray examination after the operation showed that the position had become worse and that there had developed a considerable varus deformity. On discharge 8 weeks later the patient had abnormal lateral mobility in the knee-joint.

Otherwise the fractures were treated by manipulations, now and then on a traction table with BÖHLERS calcaneus clamp on the

condyles. Fixation was accomplished by a plaster cast reaching to above the middle of the thigh, sometimes combined with a calcaneous traction. Reduction resulted in most cases in little change in the situation so that the fractures were allowed to heal in malposition often little different from the original one. Thus all the depressed fractures healed without elevation of the articular surface. In fractures splitting off the medial tibial condyle and once in bicondylar fracture, fixation was attempted by a plaster cast + different arrangements with KIRSCHNER'S wires. In one case a wire was inserted into the internal condyle of the tibia from the medial side, three times 2 wires were inserted through the tibial condyles. The leg with the wires was then fixed in plaster. One of these patients, a woman aged 79, contracted peroneus paralysis and decubitus on the outside of the knee and died at home shortly after her discharge. A few times a KIRSCHNER'S clamp was used in such a way that the condyles were pressed together thereby. Thus, in the case of a man aged 42, where reduction had been successful, a clamp was adjusted in such a way that the tibial condyles were pressed together transversely, another clamp so that the pressure from the medial side rested on the internal femoral condyle and from the lateral side on the outside of the plaster cast. With this arrangement it was not possible to maintain the position, which in the end became about the same as before reduction. On removal of the clamps after 4 weeks, the patient had complete peroneus paralysis.

The fixation was in general maintained 3 to 8 weeks, the longest period being 12 weeks. In a case of bicondylar fracture secondary dislocation developed when the plaster was removed after 5 weeks as the condyles bent over into a state of varus. Weight-bearing was generally permitted 7 to 12 weeks after the injury. Puncturing of the knee-joint was not regularly performed.

Post-investigation. 51 of the injured were post-examined in 1942 1 to 10 years after the accident, 47 were examined clinically and radiologically, 4 only by inquiry forms. 4 had died, 3 could not be traced and a boy aged 11 with open fracture in the lower end of the femur was not summoned on account of amputation of the leg at the thigh. Several stated that recovery had taken a long time, sometimes a number of years.

For purely practical reasons the patients re-examined are divided into two groups: 1. Fractures without or with minor dislocation. 2. Fractures with dislocation. More than half of the cases,

28 in all, fall within the former group. These fractures really present no problem as regards treatment and prognosis. They include the fractures of the intercondyloid eminence, the marginal fractures, 4 depressed fractures, 2 fractures splitting off the medial tibial condyle, 7 bicondylar fractures and 3 fractures of the lower end of the femur. The result as regards function was in all these cases good with exception of 2 cases, depending on special circumstances. The patients stated that the knee was quite well or that they had quite insignificant inconveniences. On examination complete mobility had been restored, good axis and no abnormal mobility. One of the unsuccessful cases was a woman, aged 56, who on examination was being treated for general paralysis in the medical department of the hospital. Her knee was painful with severe arthrosis deformans and abnormal lateral mobility, probably due to her syphilis. The other was a man, aged 43, with bicondylar fracture. After the injury he had been confined to bed at home for three months with bilateral thrombosis and several pulmonary embolisms before being sent to hospital and was by that time so stiff in both legs that he could not sit up in bed. On re-examination he was suffering from an almost rigid knee with pain and slight abnormal lateral mobility. He could only walk short distances and with much pain.

Of the 23 fractures which showed considerable dislocation 9 were depressed fractures, 3 splitting fractures in the lateral tibial condyle, 4 fractures splitting off the medial tibial condyle, 5 bicondylar fractures and 2 fractures of the lower end of the femur. It is particularly these fractures that are of interest as regards treatment and prognosis.

Depressed fractures. Four were cured with good results. All were fully capable of work, walked without limping, but stated that the knee was weaker than before the injury, that it hurt on making a false step, after undue exertion etc. All showed a slight state of valgus in the knee-joint. Two had had depressions of about $\frac{1}{2}$ cm. and two of about 1 cm., one of whom at the same time had a comminuted fracture of the upper part of the tibia.

In 2 patients, one with a depression of about 2 cm. and accompanying oblique fracture of the tibial metaphysis, the other with considerable depression of the posterior part of the articular surface of the lateral condyle, the results were found fairly satisfactory. Both patients showed a state of valgus in the knee-joint, but no abnormal lateral mobility. In one of the patients flexion

did not pass a right angle. The subjective troubles were very moderate.

Three patients had considerable inconveniences. They complained that the knee was weak and easily gave way. All had valgus deformity and lateral mobility. None of them could hop on the leg. Two could flex the knee to a right angle. The third had coarse crepitation and radiographic signs of arthrosis deformans. In these patients there was depression of the articular surface of $\frac{1}{2}$, 1 and $1\frac{1}{2}$ cm., the last accompanied by comminuted fracture of the whole lateral tibial condyle and oblique fracture through the upper part of the tibia.

The permanent injury after depressed fractures of the lateral tibial condyle was due first and foremost to a state of valgus in the knee-joint, and to reduction of the stability of the joint, in the unsuccessful cases with perceptible abnormal lateral mobility. The deformation and depression of the articular surface of the condyle remained unchanged in these non-operated cases. No certain prognosis can be made solely on the extent of the depression. Of 3 patients with depression of about 1 cm. 2 had a stable knee-joint, 1 an unstable knee with lateral mobility. One patient with a depression of about 2 cm. had a knee that was certainly weak but without clinical signs of lateral mobility. On the other hand, in one case a $\frac{1}{2}$ cm. depression caused an unstable joint. No special investigations were made by X-ray photography or translumination to ascertain whether a possible damage to ligaments played any part in the abnormal lateral mobility.

Splitting fractures. All splitting fractures with dislocation except the one operated case, had healed in malposition, in most cases with alteration of the axis of the leg in valgus or varus direction. The fracture gap was found filled with condensed bone of irregular structure with the condyle up to 1.5 cm. too broad. The functional and anatomical results showed close concordance.

The 3 splitting fractures in the lateral tibial condyle all showed a slight state of valgus in the knee-joint, but otherwise satisfactory conditions with complete mobility without lateral mobility. The patients could walk without limping, were fully capable of work and had small subjective troubles, chiefly a feeling that the knee was not so strong as before the injury.

All the 4 patients who had sustained fractures splitting off the medial tibial condyle showed bad results. The operated patient, despite that the fracture had healed in an ideal anatomical position,

had three years after the injury a knee that was stable with no tenderness, but almost rigid with flexion of only 30° from the normal initial position. The other 3 had considerable inconveniences. They complained that the knee was weak and easily gave way, that it hurt on making a false step, in lifting, when walking on uneven ground, and that it felt stiff. A state of varus was noted in all three patients, and it seemed as if the crus was laterally displaced in the knee-joint. Two could flex the knee to the full extent, one only 60° , whilst all had a defect of $5-15^{\circ}$ on full extension. Two had slight abnormal lateral mobility, none of them could hop on the leg. The peroneal paralysis that occurred in one case had completely disappeared one year after the injury.

In three of the patients with bicondylar fracture satisfactory conditions were found. Two of them stated that the knee was just as well as before the injury, the third had minor subjective inconveniences, being fully capable of work as a lumberman with a knee with good mobility and only a slight degree of valgus. The result was bad in two. A corpulent woman, aged 60, who 4 years previously had been operated with resulting aggravated dislocation, was entirely disabled and could hardly stand on the leg, which showed a severe state of varus and lateral mobility in the knee-joint. A man, aged 24, who had sustained fracture with moderate dislocation, had a knee with good axis and complete mobility, but unstable in the lateral direction. (Received 20 % disability allowance from the State Insurance Fund.)

Of the 5 post-investigated fractures in the lower end of the femur, the two showing considerable dislocation showed great inconveniences. A man, aged 67, with bicondylar fracture, the dislocation of which was only partly reduced, was lame and had pain in the knee. There was severe crepitation in the knee-joint, which could be flexed to a right angle. A 41-year-old man with open crushing fracture of the lateral femoral condyle and a wide opening into the knee-joint had a weak, unstable knee with abnormal lateral mobility, a state of valgus, and greatly restricted mobility.

Arthrosis deformans. The X-rays during the post-investigation revealed marginal exostoses in nearly half of the patients. With few exceptions, these exostoses were small and could not be regarded as indicative of progressive arthrosis deformans. In some cases they were so small that they probably could be regarded as normal for the patient's age, sometimes they were equally large in the uninjured knee, and sometimes the X-rays showed that they

had remained unchanged, often over many years. Only in the previously mentioned patient with syphilis and general paralysis was there noted a distinct progression in the affected joint. In the latter patient, who had sustained fracture of the intercondyloid eminence, was found severe arthrosis deformans. In three others was found coarse crepitation, but the X-rays revealed only small marginal exostoses. All were aged, two had sustained depressed fractures and one a fracture splitting off the medial tibial condyle healed in malposition. In none of these cases had there occurred any aggravation of the condition as indicative of a progressive disease. Arthrosis deformans seems thus to play a small part in fractures of the knee.

Discussion.

The treatment of the intra-articular fractures of the knee at Drammen Hospital has not been a subject of special attention. The fractures have been treated without uniformity, sometimes it might perhaps be said, almost fortuitously, especially as regards the operative treatment. Many of the fractures were allowed to heal with considerable malposition. None of the depressed fractures were operated, although in several cases there existed rather extensive depression. In the way the operative treatment was performed, it failed in two cases. The main principles of treatment were: Short period of fixation, early mobilisation, late weight-bearing, but as far as can be judged from the radiographs and journals, the period of fixation and when weight-bearing was allowed, were not specially adjusted to the nature of the fracture. The methods of fixation employed, as with Kirschner clamps and Kirschner wires, proved both unserviceable and dangerous and can certainly be replaced by better and firmer methods of fixation with better prospects of earlier mobilisation of the knee. Bad functional results, with a few exceptions, were only seen in cases where the fractures had healed in malposition. The function of the joint proved on the whole better than ought perhaps to be expected, considering the deformity following the fracture. Complete disablement without walking ability was found only in one case. When the functional result can be termed good in nearly three-fourths of the cases, the reason is that in more than half of the cases small fractures were in question and fractures without dislocation. As it is, in the first place, the reduction of the stability

of the knee-joint that plays a part in the bad cases, there is reason to suppose that injuries to the ligaments may be of importance. On arthrotomy was seen in two cases disruption of the anterior crucial ligament, and on post-investigation the X-ray picture revealed in 4 cases a Stieda shadow as indicative of damage to the medial collateral ligament.

There is reason to suppose that if reduction and fixation of these fractures could result in correct anatomical position, also the functional results would be better, but for this purpose operative treatment must be employed more frequently than is dealt with in this material. General rules cannot be laid down. Regard must be paid, not only to the deformity of the knee-joint due to the fracture, but also to the patient's age, his condition generally, occupation etc. It cannot be overlooked that operative treatment of these fractures is often difficult, and that there is a certain degree of danger that the prognosis will be rendered less favourable by the operative injury, if the correction of the malposition fails.

In splitting fractures the goal may certainly be reached in many cases by minor operations without arthrotomy. The most expedient procedure is probably reduction on a traction table with the drawing together and fixation of the condyles by means of wires (LANDELIUS) or by metal bolts (WEBB, KIÆR). Operative treatment of depressed fractures demands arthrotomy. The greater the depression, state of valgus and abnormal lateral mobility, the more will operative elevation of the depressed articular surface be indicated. If conservative treatment proves unsuccessful, the operation can be performed later and even a long time after the fracture has become consolidated.

Summary.

After a survey of the types of fracture, the mechanism thereof, accompanying injuries to menisci and ligaments, treatment and prognosis, an account is made of an investigation of 59 intra-articular fractures of the upper end of the tibia and lower end of the femur treated at Drammen Hospital in the period 1/1/1931 to 1/1/1941 comprising 51 fractures of the tibia and 8 of the femur. 19 of the fractures were located in the lateral tibial condyle, in 7 cases the medial condyle of the tibia was split off, in 13 cases

the fracture was bicondylar, in 6 cases were found small marginal fractures of the tibial condyles and in 6 cases isolated fracture of the intercondyloid eminence. Of the 19 fractures in the lateral tibial condyle 14 were comminuted depressed fractures, including 5 with fracture through the tibial metaphysis at the same time. Two were non-comminuted depressed fractures and three were splitting fractures. Operative treatment was adopted only in three cases, all being splitting fractures, in two of which the reduction was unsuccessful. None of the depressed fractures were operated. In most cases the fractures were treated by manipulations resulting in imperfect reduction, so that the fractures healed in a bad anatomical position. In the year 1942 51 of the patients were post-examined, 47 clinically and radiologically, 4 by inquiry forms. The results were found satisfactory in 38 cases, and bad in 13. In 28 cases we had to do with fractures without or with only slight dislocation. The bad results were due first and foremost to the fact that the knee became unstable with abnormal lateral mobility, and were seen, with a few exceptions, in cases where the fracture had healed in malposition with alteration of the axis of the leg in valgus or varus direction. Arthrosis deformans played an unimportant part. It is assumed that the prognosis can be improved by better reduction and fixation, but for this purpose it is necessary to adopt more frequent operative treatment than is stated in this material.

Zusammenfassung.

Nach einer kurzen Übersicht über Frakturtypen, Bruchmechanismus, begleitende Meniscus- und Ligamentschäden, Behandlung und Prognose wird über eine Untersuchung von 59 intraartikulären Frakturen im oberen Tibia- und unteren Femurende, behandelt im Krankenhaus in Drammen vom 1/1 1931 bis 1/1 1941, berichtet. 51 Frakturen in der Tibia und 8 im Femur. 19 der Frakturen waren im lat. Tibialcondylus lokalisiert. 7 Mal war der mediale Tibialcondylus abgesprengt, 13 Mal war die Fraktur bikondylär, 6 Mal wurden Kantenabsprengungen gefunden, 6 Mal isolierte Fraktur der Eminentia intercond. Von den 19 Frakturen im lat. Tibialcondylus waren 14 Kompressionsfrakturen, davon 5 mit gleichzeitiger Fraktur in der Tibialmetaphyse, 2 nicht komminutive Kompressionsfrakturen und 3 Spaltbrüche. Die Behandlung war nur drei Mal und zwar alle Male bei Spaltbrüchen operativ,

zwei Mal ohne dass die Reposition gelang. Keine der Kompressionsfrakturen wurde operiert. Die Reposition war in den meisten Fällen nur manuel und mangelhaft, so dass viele Frakturen in Fehllage zuheilten. 51 der Patienten wurden im Laufe des Jahres 1942 nachuntersucht, 47 klinisch und röntgenologisch, 4 durch Fragebogen. Das Ergebnis wurde in 38 Fällen befriedigend, in 13 Fällen schlecht befunden. 28 Mal handelte es sich um Frakturen ohne oder mit unbedeutender Dislokation. Die schlechten Ergebnisse rührten vor allem von einem schwachen, unsicheren Knie mit abnormer Seitenbeweglichkeit her und wurden bis auf wenige Ausnahmen bei Frakturen befunden, die in Fehllage mit Veränderung der Axe des Beins in Valgus- oder Varusrichtung zugeheilt waren. Arthrosis deformans spielte nur geringe Rolle. Es ist Grund anzunehmen, dass die Prognose durch bessere Reposition und Fragment-Fixation günstiger werden kann, doch ist hierzu häufigere operative Behandlung, als in diesem Material stattgefunden, erforderlich.

Résumé.

Après un bref aperçu sur les différents types de fractures, sur le mécanisme des ruptures, les lésions du ménisque et des ligaments qui l'accompagnent, ainsi que sur le traitement et la prognoсе en rapporte des recherches faites sur 59 fractures intra-articulaires à l'extrémité supérieure du tibia et inférieure du fémur, traitées à l'Hôpital de la Ville de Drammen dans la période décennale du 1/1-1931 au 1/1-1941. 51 fractures du tibia, 8 du fémur. 19 fractures étaient localisées à la tubérosité externe, dans 7 cas la tubérosité interne détachée, 13 fois la fracture était bicondyloire, 6 fois on avait constaté des débris aux bords, dans 6 cas la fracture isolée de l'eminentia intercondyloire. Sur les 19 cas de fractures à la tuberosité externe il y avait 14 fractures comminutes par compression dont 5 comportaient en même temps la fracture de la metaphyse du tibia, 2 étaient des fractures comprimées non comminutes et 3 étaient des ruptures en fente. Le traitement a été opératoire seulement 3 fois — toujours en cas de fractures en fente: 2 fois sans que la réposition réussît. Aucune des fractures par compression n'a été opérée. La réposition était dans la plupart des cas seulement manuelle et défectueuse et par conséquent beaucoup de fractures étaient guéries en position imparfaite. 51 patients ont été réexaminés dans le courant de 1942: pour 47 cas l'examen a

été clinique et radiologique, pour 4 cas l'examen a été fait à l'aide de formulaires. On a constaté des résultats satisfaisants en 38 cas, mauvais en 13 cas. En 28 cas il s'agissait seulement de fractures sans dislocation ou avec une dislocation de moindre importance. Les mauvais résultats étaient dus en premier lieu à un genou quelque peu infirme avec mobilité latérale anormale et ont été constatés à peu d'exceptions près dans les fractures guéries en position imparfaite avec déplacement de l'axe de la jambe dans un sens ou dans l'autre. L'arthrosis deformans jouait un petit rôle. Il y a raison de croire que la prognose peut être améliorée par une reposition plus soignée et une meilleure fixation des fragments, mais pour cela est exigé un traitement opératoire plus fréquent que dans les cas du matériel étudié.

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»Défense musculaire« und Headsche Zonen.

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(Mit 1 Abb.)

»Défense musculaire« bedeutet einen Zustand örtlicher oder allgemeiner unwillkürlicher Muskelspannung der anterolateralen Bauchwand, welcher man bei Bauchpathologie aller Art begegnet. Es handelt sich um einen gleichmässigen, präexistierenden Widerstand, der also nicht erst als Folge der klinischen Untersuchung, der Palpation bzw. des Versuchs entsteht sein etwaiges Vorhandensein zu prüfen. Diese *défense musculaire* ist von grosser praktisch-diagnostischer Bedeutung; dennoch ist ihr Entstehungsmodus nicht völlig geklärt. Das Mass der *défense* wird von allerhand nebensächlichen Umständen mitbeherrscht: akute Pathologie, jugendliches Alter und Nervosität fördern die Muskelspannung, Bauchwandüberdehnung schwächt dieselbe. Neben einer *défense musculaire* gehen oft andere Erscheinungen, Hyperästhesie (»tenderness«) einher. HEADSche Zonen sind Gebiete der Körperwand oder der Gliedmassen, in welche Schmerzen viszeraler Herkunft »ausstrahlen«, d. h. anscheinend verspürt werden. In derartigen Gebieten kann nebenbei oberflächliche Hyperästhesie, auch Hyperalgesie vorhanden sein. Es können sich sogar äusserlich sichtbare vasomotorische und pilomotorische Reaktionen in HEADSchen Zonen ereignen. Schliesslich soll es in besonderen Fällen in HEADSchen Zonen leichtere Muskelspannung geben. Demzufolge verwundert es nicht, dass *défense musculaire* und HEADSche Zonen manchmal mehr oder weniger im Zusammenhang betrachtet werden, wie es auch in diesem Beitrag der Fall ist.

Wie auch sonst gibt es in der hier behandelten Materie einen prinzipiell anmutenden Gegensatz der Ansichten des »inneren« Mediziners und des Chirurgen, m. E. zu Unrecht. Dementsprechend ist es meine Absicht, hier eine gut begründete Auffassung, zu welcher sich Ärzte der verschiedenen Teildisziplinen bekennen könnten, zu entwickeln.

Dem Chirurgen ist *défense musculaire* nahezu gleichbedeutend mit entzündlicher Bauchpathologie und Beteiligung des parietalen Bauchfells; Muskelspannung der anterolateralen Bauchwand infolge etwaiger auf ein Viszeralorgan beschränkter Pathologie scheint ihm kaum glaubhaft. In der Chirurgie ist von HEADSchen Zonen selten die Rede. Die innere Medizin dagegen ist von der Realität und der diagnostischen Bedeutung der HEADSchen Zonen überzeugt. Dies liegt auf der Hand, sind doch die Namen prominenter Mediziner — ROSS, MACKENZIE, VON BERGMANN — mit diesem Begriff verknüpft.

Manchmal wird von der inneren Medizin die Existenz nahezu aller lokalisierter Organschmerzen des Körperinnern verneint: es soll sich die Eingeweidepathologie als Schmerz nur mittels Ausstrahlung in die Körperwand usw. bemerkbar machen: *referred pain*. Grosse Bedeutung hat dabei das Prinzip der Metamerie (Segmentalanatomie): die Irradiation finde statt in dasjenige Dermatom hinein, das der theoretischen Metamerie des erkrankten Bauchorgans — etwa Darmteils — entspricht. Dieser Vorstellung gliedert sich oft der Gedanke an, es sei auch die *défense musculaire* z. B. einer Appendicitis eine Manifestation der gleichen, rein theoretischen Darmmetamerie (der Appendix). Derartige Auffassungen teilt nahezu kein Chirurg; in diesem ablehnenden Sinn haben sich COPE und LERICHE am deutlichsten ausgesprochen. Die Muskelspannung bei der Blinddarmentzündung ist nicht der Darmmetamerie entsprechend lokalisiert, sondern sie entspricht der Lage des Appendix im individuellen Entzündungsfall. Die *défense musculaire* passt der Lokalisation nach somit nur zur Metamerie des an der Entzündung beteiligten Peritoneum parietale. Dementsprechend ist die Muskelspannung im Gallenblasengebiet bei einer subhepatischen Appendicitis vorhanden und fehlt dieselbe, oder tritt sie erst spät in Erscheinung bei retrocäcaler, extraperitonealer Appendicitis.

Auch sitzt die Muskelspannung der Sigmoiditis diverticularis — klinisch Appendicitis links — segmentalanatomisch nicht tiefer als diejenige einer normallokalisierten Blinddarmentzündung.

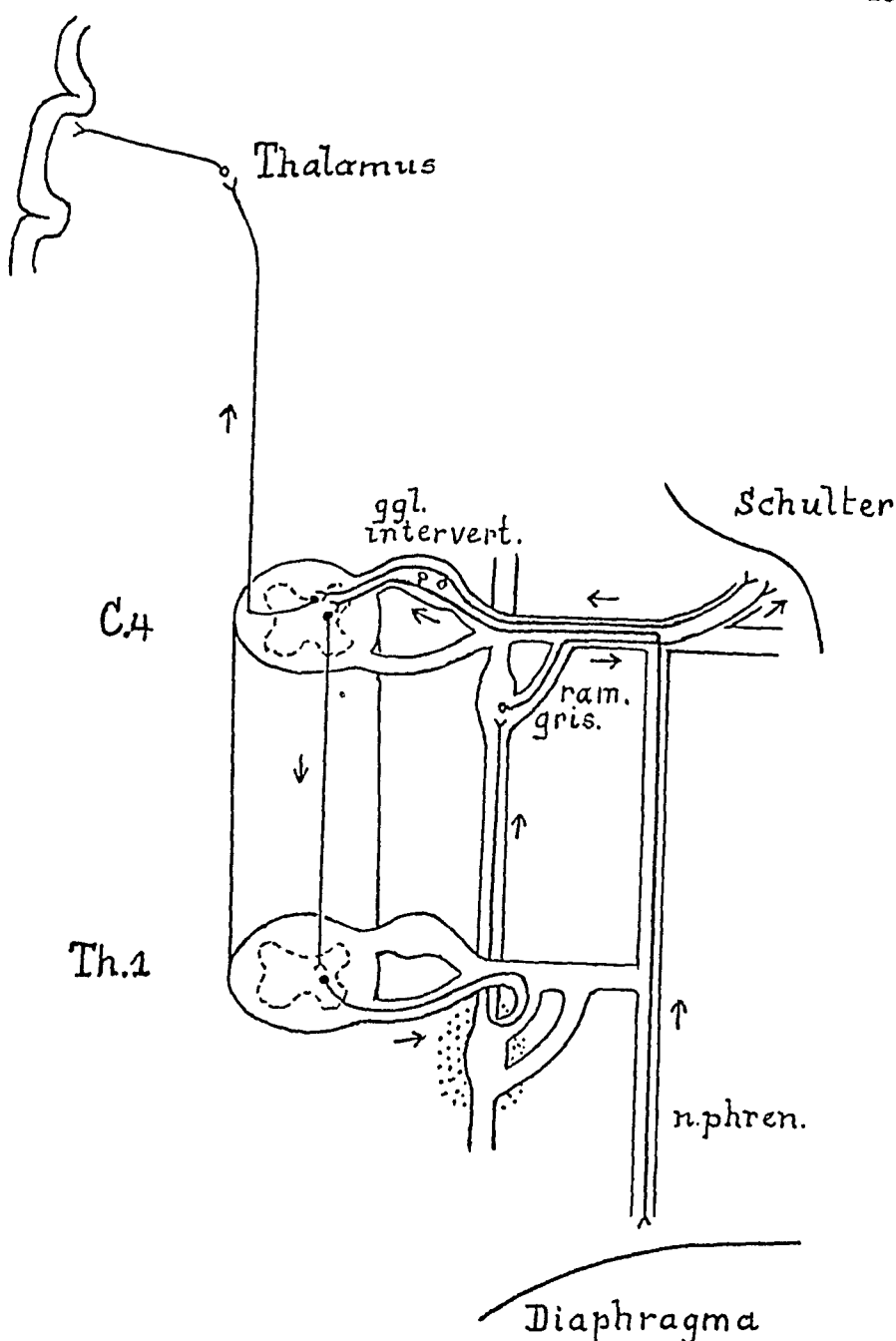


Fig. 1.

Dennoch ist theoretisch, und auch der Innervation nach ein wesentlicher metamerer Unterschied von Caecum und Sigmoid anzunehmen.

Was die Schmerzempfindlichkeit der inneren Organe betrifft, die Zeiten LENNANDERS, derzeit wurde den Eingeweiden jegliche

Sensibilität abgesprochen, sind vorüber. Ohne die gelegentliche Realität HEADscher Zonen völlig zu verneinen, sind mehrere Chirurgen von direkter, lokalisierter Schmerzempfindlichkeit der Eingeweide überzeugt, so z. B. LERICHE. Nebenbei wird auch referred pain gefühlt, vielleicht auch einmal nur dieser. HEAD selber war der Meinung, dass zu der Pathologie seröser Höhlen, z. B. zur Peritonitis, keine Schmerzirradiation und auch keine oberflächliche Hyperästhesie gehöre. Beide seien nur Begleiterscheinungen viszeraler Organpathologie.

Ein bedeutsamer Teil der medizinisch-chirurgischen Kontroverse erklärt sich aus der Tatsache, dass die detaillierte spezielle Diagnostik bei offenem Bauch, somit die chirurgische, der klinischen und röntgenologischen Diagnose der inneren Medizin überlegen ist. Was der Mediziner als Folgen viszeraler Pathologie — z. B. Gallenblasenhydrops oder Steinkolik — betrachtet, kann sehr wohl in der begleitenden parietalen Pericholecystitis begründet sein. Und manche gedeckte Magenperforation entzieht sich der inneren Diagnostik. Dieser Umstand verringert die Beweiskraft aller Kasuistik, der keine operativen Befunde zugrunde liegen, schaltet dieselbe m. E. aus. Eine wohlbegründete Auffassung in der einschlägigen Materie kann nicht nur aus Erwägungen gefolgert werden.

Grosse Bedeutung ist den modernen Methoden variierter örtlicher und Leitungsanästhesie beizumessen. Sie ermöglichen die Beantwortung mehrerer Fragen. Die entsprechenden Verfahren sind immerhin nicht alle neu, und schon vor zwanzig Jahren haben LÄWEN, KAPPIS und KULENKAMPF sich derselben bedient. Diesen Autoren und auch ALVAREZ verdanken wir grundlegende Daten, die allerdings nicht das Gesamtproblem umfassen. Diese älteren Forschungen wurden von VON BERGMANN angeregt. Einige Bemerkungen über die Wege der Eingeweidesensibilität sind vor auszuschicken; sie befassen sich besonders mit den Bauchorganen. Die Nn. vagi sind an dem Zustandekommen von Oberbauchschmerzen nicht beteiligt, sie steuern auch nicht zu Schmerzausstrahlung bei. Die Nn. vagi dienen nur organspezifischen Reizen, wie auch der Beckenparasymphicus (Nausea, Orgasmus, usw.). Doch folgt ein Teil der zu Erbrechen führenden Oberbauchreize, genau so wie die Schmerzreize, sympathischen Nervenwegen der Nn. splanchnici. Der N. phrenicus ist auch der sensible Nerv des Zwerchfells. Die Schmerzfasern des Herzens ziehen durch sympathische Bahnen zu den höheren thorakalen Rr.

communicantes. Die Vagusäste führen die nicht schmerzenden Reize, welche den bekannten negativen Tropien zugrundeliegen.

Schmerzreize aus dem sonstigen Bauchraum gehen über den Lendensympathicus und über dessen höhere Rr. communicantes.

Einige methodisch wichtige anatomisch-topographische Tatsachen sind noch zu erörtern. Im Brustkorb fehlt leider die Möglichkeit der Unterbrechung der viszeralen Innervation ohne gleichzeitige Ausschaltung der parietalen Nervenstämme der gleichen Segmente (die Interkostalnerven erholen sich allerdings eher). Im Thorakalgebiete liegen die Grenzstrangganglien den Nn. intercostales zu nahe; woran auch ihre gesonderte Novokainisation bzw. Alkoholisation scheitert. Im unteren Brustkorb können wenigstens die Splanchnicuswurzeln — sie liegen weiter ventromedial — gesondert novokainisiert werden, bei erhaltener Parietalsensibilität. Entsprechendes verwirklicht die sog. Splanchnicusanästhesie (KAPPIS), die am Ganglion coeliacum beiläufig auch die Vagusfasern unterbricht. Schliesslich lässt die Novokainisation des Lendengrenzstranges, der vor dem Psoasmuskel von den Lumbalnervenstämmen weit entfernt ist, dieselben unberührt; sie ist eine ausschliesslich viszerale Sensibilitätsblockade.

Die Paravertebralanästhesie unterbricht sofort neben der Wirbelsäule sowohl die Nn. intercostales bzw. lumbales, als deren Rr. communicantes und gelegentlich auch die entsprechenden sympathischen Grenzstrangganglien: parietale und viszerale Anästhesie. Dasselbe erreicht irgendeine Methode gürtelförmiger Spinalanästhesie: ich ziehe die peridurale, scharf segmentbegrenzte Betäubung mittels einer viskösen Pantokainplombe (GOEPEL) vor. Die althergebrachte subarachnoidale Lumbalanästhesie mit ihren unberechenbaren und unscharfen Begrenzung und ihren Risiken eignet sich nicht zu dieser Untersuchung. Ausschliessliche Betäubung der Körperwand erhält man mittels interkostaler Einspritzung in einiger Entfernung von der Wirbelsäule: die Rr. communicantes bleiben frei. Die Narkose kommt für eine Untersuchung, die sich auf die subjektiven Angaben der Patienten stützt, nicht in Betracht.

Man könnte sich fragen, ob es statthaft sei, an Patienten Untersuchungen vorzunehmen, die doch eigentlich Versuche sind. Die Antwort lautet dahin, dass derartige Untersuchungen manchmal nicht nur statthaft sondern sogar indiziert sind. Der palliative Erfolg der paravertebralen oder Splanchnicusanästhesie übertrifft bei mancher Kolik denjenigen gewohnheitsmässiger Opiatinjek-

tionen, denen Spasmolyticis zugesetzt sind. Manche der hier erwähnten Novokaineinspritzungen dient zugleich der operativen Hilfe, indem sie die Narkose überflüssig macht. Bisweilen tritt die Periduralanästhesie an die Stelle der Narkose zur Ermöglichung einer ausschlaggebenden Palpation. Dann und wann führt elektive Novokainisation eine diagnostische Entscheidung herbei, die auf andere Weise unerreicht geblieben wäre; eine scharfe Indikation kann derselben auch entstammen. Es gibt somit zahlreiche medizinisch ethisch verantwortete Gelegenheiten zur Sammlung klinischer Daten zum Studium der *défense musculaire* und der HEADSchen Zonen.

Im nunmehr Folgenden bedeutet ein Patient mit ... z. B. *Hydrops vesicae felleae* ..., dass sich an diesem auf dem Operationstisch auch nichts Anderes herausgestellt hat; dies ist nicht stets besonders bemerkt. Und jetzt zuerst einige der chirurgischen Klinik entlehnte Tatsachen, die den Folgerungen dieses Aufsatzes zugrundeliegen.

Falls bei einem Patienten mit palpablem Widerstand rechts im Oberbauch — etwa mit (geringer) Muskelspannung daselbst — und vielleicht Kolikschmerzen, der Schmerz vollständig durch ausschliessliche Splanchnicusanästhesie verschwindet, kann von einer Pericholecystitis bei Empyem der Gallenblase nicht die Rede sein. Sollte Paravertebraleinspritzung an Th. 9—10 dasselbe erreichen, so ist Nierenpathologie und auch etwa subhepatische Appendicitis ausgeschlossen. Die paravertebrale Blockade von Th. 12—L. 2, der Weg der viszeralen Nieren- und Appendixsensibilität, nützt dann nichts. Die Operation wird dann zeigen, dass nicht peritoneal-entzündliche Gallenpathologie vorliegt. Jede der beiden Anästhesieformen wird an sich etwa vorhandene *défense musculaire* behoben haben, sowie auch alle möglichen Manifestationen einer HEADSchen Zone (rechtsseitiger Gürtel-, Rücken- oder Schulterschmerz). Letzteres erreicht auch die ausschliesslich parietale (interkostale, nicht-paravertebrale) Novokainisation; der innere (Kolik) schmerz dauert dann uneingeschränkt fort. Subkutane Anästhesie im einschlägigen Gebiete kann auch erfolgreich sein; sie ändert die Muskelspannung jedoch nicht.

In einem ähnlichen Falle, in welchem die starke *défense musculaire* es kaum erlaubt, eine etwaige Organvergrösserung herauszupalpieren, behebt die ausschliesslich viszerale Betäubung das Gefühl der inneren Spannung oder sogar des Kolikschmerzes. Oberbauchschmerz und Muskelspannung bleiben jedoch unge-

ändert. Dann muss peritoneale Pathologie vorliegen: Mitbeteiligung des parietalen Bauchfells (Kontaktperitonitis, KULENKAMPF); die Operation ergibt Cholecystitis und Pericholecystitis. Ich erhielt den Eindruck, dass in derartigen Fällen die Manifestationen einer HEADSchen Zone zu einem guten Teile unterdrückt werden: wenn auch die Hyperästhesie nicht verschwindet, so wird doch der Spontanschmerz des Rückens und der Schulterblattregion behoben. Ausgiebige, ausschliesslich parietale, Anästhesie des rechten Oberbauches verringert die Muskelspannung der (Peri-) Cholecystitis bis auf einen winzigen Rest; etwaiger Kolikschmerz wird nicht betäubt. Wie zu erwarten war, verschwinden auch die HEADSchen Manifestationen. Eine kombinierte parietale und viszerale Anästhesie — etwa mittels der periduralen Pantokainplombe — behebt alle pathologischen Erscheinungen: Kolik, Muskelspannung, HEADSche Zone und ermöglicht auf diese Weise eine ideale klinische Untersuchung, Palpation, vor der Operation.

Die Möglichkeit zu Parallelbeobachtungen bei Blinddarmerkrankungen ergibt sich oft: der akuten Appendicitis stehen dann die kolikartigen Striktur- und Atresieschmerzen der »chronischen« Appendicitis gegenüber. Die Appendix sowie der Harnleiter entspricht viszeralsensibel den Segmenten Th. 12—L. 2., Eine Differentialdiagnose dem letzteren gegenüber ist der Untersuchung mittels partieller örtlicher Betäubung also nicht zu entnehmen.

Zur Behebung der Schmerzen einer Hydronephrose oder Ureterkolik genügt viszerale d. h. lumbale Novokainisation des sympathischen Grenzstranges. Für die Niere wird man weiter kranial blockieren, etwa auch den gleichseitigen N. splanchnicus unter dem Diaphragma novokainisieren. Falls die Schmerzbetäubung schon ohne Einbeziehung des N. splanchnicus vollständig wird, ist Gallenpathologie ausgeschlossen. Etwaige défense musculaire bei derartiger urologischer Pathologie verschwindet infolge der den Schmerz (die Kolik) behebenden, ausschliesslich viszeralen Betäubung.

Die gelegentliche sehr straffe Muskelspannung der Lenden- gegen bei der Paranephritis (Nierenkarbunkel) — einem zwar extraperitonealen aber doch die Körperwand einbeziehenden Prozess — wird nur durch kombinierte Anästhesie: paravertebral oder spinal behoben. Ich möchte nicht entscheiden, inwieweit die elektive viszerale Novokainisation tatsächlich mehr als Anästhesie ist. Es könnte die gleichzeitige Unterbrechung der auto-

nom-efferenten Innervation zusätzlich spasmolytisch wirken. Das wäre rationeller als die generalisierte Bedeutung der spasmolytischen Pharmaka.

Beim Ileus handelt es sich um derart heterogene Pathologie, dass von typischen lokalisierten Erscheinungen im Sinn der *défense musculaire* oder HEADScher Zonen nicht die Rede sein kann. Der Darmverschluss, solange diesen nicht durch Entzündung kompliziert ist, geht selten neben nennenswerter Muskelspannung einher. Sonst würde man nicht so oft Darmektasie, Peristaltik und Steifung wahrnehmen können. Dennoch findet sich manchmal leichtere Muskelrigidität, dem Individualfall entsprechend lokalisiert. Charakteristische HEADSche Zonen sind beim Ileus nicht bekannt; vollständige Viszeralanästhesie bringt eventuelle *défense musculaire* und Hyperästhesie zum Verschwinden.

Ulkusranke bieten zu diesem Aufsatz nur wenig Besonderes. Splanchnicusanästhesie betäubt die Schmerzen penetrierender, dorsaler Geschwüre, unterdrückt gleichzeitig den (referred pain) Rückenschmerz. Gelegentliche Muskelspannung in epigastrio ist immer der gedeckten Ulcusperforation verdächtig, also der Kontaktperitonitis suspekt. Ich zweifle jedoch nicht daran, dass es auch durch Laparotomie gesicherte Fälle gibt, die bei völlig intaktem Peritoneum *défense* und Hyperästhesie-Hyperalgesie aufgewiesen haben. Es hat dann nicht ein peritoneo-parietaler Reflex sondern eine viszero-parietaler (viszero-parietomotorischer) vorgelegen.

Patienten mit einer Angina pectoris verspüren ihre Schmerzen nicht nur präkordial, sondern auch im Herzen selbst. Sogar bei operativem Manipulieren am Ggl. stellatum oder bei seiner Punktion wird oft über Herzschmerzen geklagt. Ausserdem gibt es dann den in den ulnaren Armrand ausstrahlenden Schmerz (referred pain). Eine leichte Steifigkeit der Brust- und Schultermuskeln ist dabei nichts Ungewöhnliches; sie kann sogar eine Adduktionskontraktur herbeiführen. Auf mehrere Weisen gelingt es meistens, die anginösen Anfälle zu verhüten bzw. zu kupieren: Hinterwurzelresektion von Th. 3—6 per laminectomiam, peridurale Betäubung dieser Segmente, Alkoholeinspritzung an die entsprechenden Rr. communicantes, Stellectomie oder Novokainisation des Ggl. stellatum, dies sind alles therapeutische Möglichkeiten. Auch dabei ist es sehr wohl denkbar, dass die Anfälle nicht nur schmerzlos gestaltet werden, sondern dass die Aus-

schaltung des Ggl stellatum wenigstens auch den Koronarspasmus behebt und dass dies nebenbei eine kausale Therapie ist. Jede viszerale Anästhesie des Herzens kupiert zugleich die in diesem Sonderfall recht typische HEADsche Zone. Ausschliesslich parietale (Schulter- und Arm-) Betäubung lässt den anginösen Anfall unberührt, verhütet jedoch sämtliche Manifestationen der HEADschen Zone. Die erforderliche Anästhesie soll recht weit proximal, am Plexus angreifen, damit auch die Muskelrigidität restlos verschwindet. Mir scheint der Erfolg der défense der Schultermuskeln gegenüber nicht konstant, doch hat man hier ein Beispiel einer défense musculaire, welcher Organpathologie, nicht Pathologie einer serösen Haut zugrundeliegt. Die Mehrheit der Patienten mit einem Geschwürdurchbruch wird von »rheumatischen« oberen Schulterschmerzen, meistens links, geplagt. Ähnliches gibt es bei geplatzter Extrauterin gravidität und beim subphrenischen Abszess. Die innere Medizin begegnet diesem Schulterschmerz bei der Pleuritis diaphragmatica. Diese typische Form des »referred pain« ist somit die Folge einer Zwerchfellreizung und zwar der Reizung der Serosabekleidung (Peritoneum oder Pleura). Der Name Phrenicusschulterschmerz besagt, dass der diaphragmale Reiz längs dem N. phrenicus das Zervikalmark erreicht. Der irradierte Schmerz sitzt dementsprechend in den entsprechenden Schulterdermatomen; er ist mit Hyperästhesie und -algesie, bisweilen mit vaso- und pilomotorischen Reaktionen verbunden. Alle diese Manifestationen der HEADschen Zone werden behoben durch subkutane Schulterbetäubung; tiefere Anästhesie verbessert den Erfolg. Dennoch bleibt die Bahn des N. phrenicus vom Novokain unberührt; und da es keinen Zwerchfellschmerz gibt, bleibt nur eine Einschränkung der Atemexkursionen übrig. Alleinige Phrenicusblockade verhütet nicht nur den Schulterschmerz, sondern befreit auch die Atmung. Der Gegensatz hierzu ergibt sich aus operativer Phrenicusquetschung — bei Exhairesoperationen: Schulterschmerz und angehaltene Atmung. Der Phrenicusschulterschmerz ist ein Beispiel der Schmerzirradiation (referred pain) anlässlich kasueller Serosopathologie.

Das sind die experimentellen klinischen Daten, die bisher vorliegen. Einem Einwurfe ist noch Rechnung zu tragen: die parietale Anästhesie — falls nicht subkutan — ist zugleich eine motorische Blockade, die allerdings meistens später in die Erscheinung tritt und auch kürzer dauert, dazu weniger vollständig ist.

Die motorische Unterbrechung könnte am Verschwinden der *défense musculaire* bei entzündlicher Serosapathologie beteiligt sein. Die diesbezügliche Entgegnung scheint mir jedoch unwesentlich.

Einige Worte sind der Eigenart der behandelten Erscheinungen und Funktionen zu widmen.

Das Schmerzgefühl der inneren Organe ist der auch dem Laien bekannten Hautsensibilität sehr unähnlich. Das dürfte demjenigen, der die Teleologie nicht a priori verwirft, nicht wundern. Die animale Sensibilität hat eine andere Aufgabe: den Schutz des Organismus in dessen Relation zur Aussenwelt. Dazu dienen die lokalisierten Modalitäten der Hautsensibilität sowie die Propriozeptoren. Der im allgemeinen wenig scharf lokalisierte Viszeralschmerz der vegetativen Nerven dient der inneren Erhaltung. Der Unterschied ist morphologisch und funktionell festgelegt. Der Berührungssinn fehlt den Eingeweiden; der aggressiven Chirurgenhand ist nicht Rechnung getragen. Die Viszeralsensibilität befasst sich nahezu nur mit dem Kontraktionszustande der glatten Muskulatur der Eingeweide und der viszerale Gefässe. Bewusst wird sie uns bei Gefässkrämpfen oder anderen — Verengerungen (BUERGERsche Erkrankung, Periarteriitis nodosa), sowie bei spastischer Kontraktion bzw. bei Dehnung hohler, röhrenförmiger Organe. Zug an den Mesenterien spielt bei letzteren offenbar eine wichtige Rolle. Anoxie ist beim ersteren wahrscheinlich Hauptsache (Angina pectoris). Die Sensibilität des parietalen Bauchfells und der Pleura nähert sich, auch lokalisatorisch der Hautsensibilität; sie wird auch nicht von vegetativen Nerven besorgt.

Der Unterschied der äusseren und inneren Sensibilität ist auch in anderem begründet. Es scheint LÉRICHE und auch mir, dass der gebildete Laie von der Topographie der inneren Organe für eine genaue Lokalisation seiner Sensationen zu wenig weiss. Er weiss kaum mehr als die Lage des Herzens, wo es klopft; des Magens, »wo es sich füllt« beim Essen; der Harnblase und des Mastdarms, deren Entleerung sich auch äusserlich manifestiert. Bedeutend weiter kommt er, falls überstandene ähnliche, doch andersartige Beschwerden ihm spezielle Kenntnisse beigebracht haben. Dann versteht er sich besser auf innere Lokalisation seiner Schmerzen: zeigt nicht nur an der Haut an, wo es drinnen schmerzt. Dann kennt er den Unterschied zwischen »von neuem der Ureter (stein)« und »diesmal etwas anderes«, z. B. der Appendix.

Was eigentlich *défense musculaire* ist, weiss man nicht genau; besonders ist nicht bekannt, welche Nervenbahnen den tonischen(?) Muskelkontraktionszustand hervorrufen. Sowohl viszerale (Organ-) Reize als parietalperitoneale bilden den Ausgangspunkt des Reflexes. Über den efferenten Weg ist nichts bekannt, weiss man doch nicht einmal im allgemeinen, was Muskeltonus ist und welche Nerven denselben steuern. Am Mechanismus der *défense musculaire* könnten somatomotorische und autonome Nerven beteiligt sein. Mir ist bisher nicht ersichtlich, auf welche Weise sich eine Entscheidung am kranken Menschen durchführen liesse. Es gibt kein Verfahren, das es ermöglicht, die sympathische Innervation der Körperwand gesondert auszuschalten ohne gleichzeitige Blockade der sensiblen, afferenten Wege.

Auf welche Weise *referred pain* zustande kommt, ist nunmehr für den Sonderfall des Phrenicusschulter Schmerzes sichergestellt. Um periphere Projektion — wie beim Phantomgefühl einer amputierten Extremität — handelt es sich keineswegs: der Zwerchfellreiz teilt sich im Halsmark nicht einfach — diffusionsweise — den somatosensiblen Schulterfasern mit. So steht es allerdings noch in nahezu allen Büchern. DAVIS konnte an Versuchstieren zeigen, und ich bewies es am Patienten, dass zum Zustandekommen der *referred pain* (irradierten Schmerzes) die Integrität der autonom-efferenten Innervation der entsprechenden HEADschen Zone erforderlich ist, genau so wie die parietalsensible Nervenversorgung. Dem ausstrahlenden Schmerz liegt somit doch irgendein Geschehen in der Körperwand zugrunde. Die gelegentlichen Parallelerscheinungen in der HEADschen Zone — Piloarreaktion und Vasokonstriktion — legen den Gedanken nahe, dass es sich um reflektorische Ischämie handelt, welche bekanntlich auch sonst Hyperästhesie und -algesie, sowie Spontanschmerz verursacht. Der ischämische Schmerz wäre auch mit dem Namen rheumatisch vortrefflich bezeichnet; auch ist er nicht auf die Haut beschränkt. Der HEADschen Zone (Schultergegend) entstammt also ein tatsächlicher sensibler Reiz; es hat nicht nur den Anschein.

Die Tatsache, dass die sympathische Innervation der HEADschen Zone in sensiblen Hautnerven enthalten ist, schwächt diese Ausführungen nicht ab: es könnten diese Nerven allerdings eine doppelte Bedeutung für die Schmerzausstrahlung haben. Vielleicht werden einzelne der besprochenen Reflexe schon vor dem Rückenmark geschlossen, z. B. im Ggl. stellatum; die segmentale Ausbreitung verstreicht dann mehr oder weniger, vgl. das Schema.

Diese neue Auffassung des Mechanismus der Schmerzirradiation ist zwar verwickelter als die klassische; über zu dieser Konzeption sind keine besonderen, neuen Nervenwege erforderlich: sie bedient sich derselben Wege, die schon zur Erklärung der Gefäßreaktionen usw. heranzuziehen waren.

Künftige Befunde an übrigens sehr seltenen Patienten könnten eine bedeutsame Bereicherung des Tatsachenmaterials liefern. Mir schweben Patienten vor, die von einer Appendicitis oder Gallenerkrankung befallen werden und die anlässlich einer früheren Laminektomie einige Hinterwurzeln im entsprechenden Gebiete verloren haben. So gibt es mehrere Möglichkeiten.

Die angeführten Tatsachen sind auch für die Nachbehandlung Frischoperierter wichtig. Wiederholte örtliche Betäubung der Bauchwand bezweckt, die Laparotomiewunde schmerzlos zu gestalten, die Atmung zu erleichtern und der Pneumonie vorzubeugen. Mittels spinaler (periduraler) Anästhesie, auch Lumbalanästhesie, lässt sich der postoperative Meteorismus einschränken. Sie bekämpft die inneren und Bauchwandschmerzen zugleich. Auch mittels paravertebraler Einspritzung an Th. 9—10 bekämpft man die tiefen postoperativen Schmerzen, doch nur diese, einer Gallenlaparotomie.

Zusammenfassung.

Nicht nur HEADSche Zonen sondern auch *défense musculaire* sind gelegentlich die Folge viszeraler Organpathologie. Kontaktperitonitis verschuldet nicht nur Muskelspannung, sondern auch Hyperästhesie und sonstige HEADSche Manifestationen. Bei der Kontaktperitonitis überwiegt die Muskelspannung; bei Organpathologie ohne Bauchfellbeteiligung tritt die HEADSche Zone in den Vordergrund. Beim Zustandekommen der zugrundeliegenden viszeroparietalen bzw. peritoneoparietalen Reflexe gewinnen grundverschiedene vegetative und somatische Nervenwege Anschluss an gemeinschaftliche efferente Reflexbahnen der Körperwand. Die Gesamtheit der einschlägigen somatomotorischen und autonomen (sympathischen) Fasern könnte als »final common path« bezeichnet werden. Es drängt sich eine Analogie zum alten Brauch, der ihn auf das somatomotorische periphere Neuron beschränkt, auf. Mit der Anästhesie des reflexogenen Gebietes verschwinden Muskelspannung und HEADSche Zone. HEADSche Zonen sind nicht »Irradiationsfolge«, sondern

sie entstammen einer Reflexwirkung. Ein sympathischer Reflex verursacht nicht nur gelegentlich zusätzliche Gefäß- und sonstige Reaktionen, sondern er ist das Wesentliche der HEADschen Zone

Summary.

Not only the HEADsch zones but also the muscular defence are occasionally the outcome of the visceral organic pathology. Contact peritonitis is not only the cause of muscular tension but also hyperesthesia and other HEADsch manifestations. In contact peritonitis muscular tension is predominant whereas in organic pathology, excepting the peritoneum, the HEADsch zones come to the foreground. When the condition for the established visceroparietal and peritoneoparietal reflexes arises they gain fundamentally different vegetative and somatic nerve paths joining on mutual efferent reflex paths in the walls of the body. The comprehension of the somatomotorial and autonomous (sympathetic) fibres belonging to this can be characterized as the final common path. An analogy with old usage makes itself manifest which confines itself to the somatomotorial peripheral neurone. In anaesthetization of the reflexogenic region the muscular tension and HEADsch zones disappear. The HEADsch zones are not a consequence of irradiation but originate from reflex action. A sympathetic reflex not only causes occasional supplementary cells and other such reaction but is the main essential in the HEADsch zones.

Résumé.

Il n'y a pas que les zones de HEAD qui dépendent de la pathologie organique viscérale: à l'occasion, la défense musculaire peut aussi être causée par elle. La péritonite par contact n'est pas responsable de la seule contracture musculaire, mais encore de l'hyperesthésie et d'autres manifestations du groupe de HEAD. Dans la péritonite par contact c'est la contracture musculaire qui l'emporte; dans la pathologie viscérale sans participation du péritoine c'est la zone de HEAD qui est au premier plan. Quand se produisent les réflexes viscéro-pariétaux d'une part, ou péritonéo-pariétaux de l'autre, qui sont à la base des phénomènes, des voies nerveuses végétatives et somatiques foncièrement différentes entrent en connexion avec des voies réflexes communes.

efférentes de la paroi du corps. On pourrait appeler «Final common path» l'ensemble des fibres somatomotrices et autonomes (sympathiques) qui sont en jeu. L'analogie avec l'ancienne coutume de le limiter au neurone somatomoteur périphérique est frappante. Par l'anesthésie de la région réflexogène on voit disparaître la contracture musculaire et la zone de HEAD. Les zones de HEAD ne sont pas dues à une irradiation mais à une action réflexe. Un réflexe sympathique ne provoque pas seulement, et occasionnellement, des réactions vasculaires et autres surajoutées: il est l'essentiel dans l'apparition de la zone de HEAD.

Schrifttum.

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Headache after Spinal Anesthesia and a Technique for Lessening its Frequency.

By

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One of the commonest and most important complications of spinal anesthesia¹ is the headache which sometimes occurs after the operation. Different authors give a very different frequency for the headaches (WEINSTEIN 70 % — SEBRECHTS rare exceptions), but in most tabular summaries we find values of 15—30 %. Headache is stated to be more common in patients younger than forty years and in women. The possibility of having a headache does not seem to be affected by the nature of the operation.

The headache usually ensues on the first—fifth day after the operation. Distinction can be made between moderate headache which lasts 3—4 days and gives way to simple analgesics, and severe headache, which in certain cases may last for months and be very resistant to treatment.

Two types of headache can be distinguished. Firstly, a rare type, where the ache is of a splitting character. In such cases we usually find a raised intradural pressure, an increased number of cells and a larger amount of albumin in the spinal fluid. This type of headache does not react favourably to a bed position with a lowered head-end.

The second and commoner type is marked by a band-like oppressive ache round the head, sometimes more pronounced in the forehead or nape. The ache is usually aggravated if the patient is in movement and is then often combined with vertigo. It tends to diminish when the patient keeps quiet and lies with his head low. In these cases a reduced intradural pressure has been regularly

¹ Spinal anesthesia here and in the sequel means intradural anesthesia.

observed. The combination between a headache of this type and reduced intradural pressure is well-known. It is considered that the headache in such cases is caused by the reduced pressure. This is indicated also by the fact that an intradural injection of 15—20 cc isotonic fluid immediately relieves the pain for a short time.

The first-mentioned type shows the picture of a meningism. The meningism may be precipitated by infection, irritation by the anesthetic or irritation by the needle. Infection is precluded as far as possible by careful sterilization. Various anesthetics have been tested with a view to obtaining one which is less irritant, but, as mentioned further on, no preparation which is markedly better than the others in regard to the causation of headache has yet been found. Finally, a finer needle should cause less irritation of the tissues than a thicker one.

Table 1.

Low and medium high spinal anesthesia with a 5 % solution of etocain, 1—3 cc intradurally. Puncture with a needle 0.7—0.9 mm in diameter. Followed by a bed position with a lowered head-end for 24 hours. The table comprises 362 anesthetics.

	Moderate headache	Severe headache	Number of anesthetics	Frequency of headache
< 20 years . .			10	0/10 = 0 %
20—29 " . .	15	5	114	20/114 = 17 %
30—39 " . .	10	2	68	12/68 = 18 %
40—49 " . .	3	1	54	4/54 = 7 %
50—59 " . .	3	0	41	3/41 = 7 %
60—69 " . .	3	1	36	4/36 = 11 %
70—79 " . .	3	0	38	3/38 = 8 %
80—89 " . .	0	0	1	0/1 = 0 %
	37	9	362	46/362 = 13 %

Patients older than 40 years incur considerably less risk of headache than younger patients. Out of the 362 cases, 20 were women and among them headache occurred in 8. The frequency of headache for the whole material was 13 %. Severe headache occurred in 2.5 %. 47 % of the patients were older than 40 years.

As mentioned above, the cause of the second and commoner type of headache is considered to be the reduced intradural pressure. The latter, in turn, may be entailed by diminished

production, increased resorption or leakage of spinal fluid. Changes in production and resorption may be precipitated by irritation by the anesthetic or the needle.

Different anesthetic agents have been tested. BACKER-GRÖNDAHL (1932) has compared several (procain, novocain, parocain, percain), but has found approximately the same frequency of headache for all of them (18 %). At this hospital a 5 % solution of etocain, 1—3 cc intradurally, was formerly used. Puncture with a needle 0.7—0.9 mm in diameter. The patients were kept in bed with a lowered head-end for 24 hours after the operation. The results are shown in the above table.

We find in Table 1 that patients over the age of 40, incur considerably less risk of headache than younger patients. This agrees well with the results found by other investigators. The number of women is too small to permit us to judge the part played by sex. The frequency of headache for the entire number of patients is 13 %: thus, a rather low figure. It is explained, however, by the inclusion of a relatively large number of patients over the age of 40. In this material they amount to 47 %, whereas in that of BACKER-GRÖNDAHL the corresponding number is 37 %.

TILLEGARD and GORDH (1945) have tested Decicain¹ (pontocain + 10 % glucose). They found a frequency of headache of 10 % for the whole material (280 cases), but in those tests patients above the age of 40 amounted to as high a figure as 67 %.

To judge by these results, the chief cause that induces a headache or reduces the liquor pressure seems to be connected with the needle and the puncture procedure. This is indicated also by the fact that in puncture of the dural membrane for diagnostic purposes, without the injection of any drug, a frequency of headache of 10—25 % is found.

In spinal puncture, a channel is made through the tissues from the skin into the dural membrane. The extradural tissues, the skin, the muscles, etc. have a strong tendency to close such a channel. This, however, does not seem to be the case with the dura. — The dural membrane is built up of fibrous connective tissue with a rather copious interspersation of elastic fibres. The direction of the fibres is mainly longitudinal. The inner and outer surfaces are clothed with a layer of endothelium. The thickness of the dura varies between 0.3 and 0.5 mm. — A needle inserted through the dural wall tears off a number of the fibres

¹Made by ASTRA, Södertelje, Sweden.

composing the wall, and a permanent opening in it ensues. This is illustrated by Fig. 1, which shows a puncture after the lapse of 2 days. The puncture has the typical »crescent-like» appearance produced by a bevelled needle. Sections from this opening show no signs of incipient healing.

Fig. 2 shows the condition in a patient who died 14 days after the puncture. A distinct opening can still be macroscopically observed. Sections from different parts of the opening show healing commencing from the corners of the »crescent».

In Fig. 3 we see the situation after the lapse of 40 days. Macroscopically a scar in the dura. Microscopically, we find that the defect is being filled with newly-formed tissue. Serial sections show that the opening is completely filled up. The preparations in Figs. 1—3 are post-mortem sections from man.

The above indicates that a passage from the intradural to the extradural space may exist for a fortnight and doubtless in many cases still longer.

The intradural spinal-fluid pressure amounts normally to 100—200 mm of water. Extradurally, we find as a rule a negative pressure, which may sometimes amount to 50 mm of water. As this very considerable difference in pressure exists, there must be a leakage of fluid through the extradural space.

That this is actually the case can be observed if a roentgen contrast substance is injected intradurally, as occurs, for example, in the ordinary myelographs. Fig. 4 a shows a case in which oxygen was injected intradurally with a needle 1.0 mm in diameter. Shortly afterwards, we find that a considerable quantity of the gas had leaked out epidurally. The same phenomenon has been observed with fluid roentgen contrast (abrodil) fig. 4 b. Since the adoption of the use of finer needles (0.7 mm in diameter), such leakage has not been observed (LINDBLOM 1945). This immediate leakage seems to explain certain cases of "Versager". The anesthetic lodges, entirely or partly, extradurally and thus has not the intended effect.

When the fluid has issued epidurally, it is resorbed or flows away via *foramina intervertebralia*. AYER (1934) showed that smoke-black injected into the system of a cat could afterwards be found between the cervical muscles. THORSÉN (1944) injected dye intradurally in man and, on the following post-mortem, showed the dye epidurally and in *foramina intervertebralia*. The abrodil, which in the above-mentioned case had lodged epidurally,

was very rapidly resorbed. Several ml had disappeared after 4—5 minutes.

In order to form an idea as to the rate at which extradurally supplied liquid is carried away, the test shown in Fig. 5 was arranged. A rather thick needle (0.6 mm in internal diameter) was inserted extradurally. The puncture needle was connected by a rubber tube with a pipette. The entire system was filled with physiological saline solution. Afterwards the pipette was

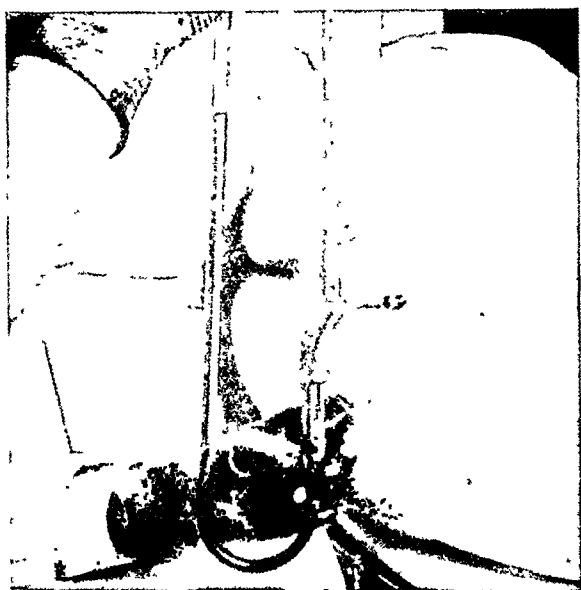


Fig. 5. *Apparatus for measuring the extradural uptake of fluid.*

Needle (internal diameter 0.6 mm) inserted extradurally. Connected by a rubber tube with a measuring pipette. The whole system filled with physiological saline solution. A difference of level of 110 mm is maintained between the free surface of the liquid and the point of the needle.

adjusted in such a way that a difference in level of 110 mm was maintained between the point of the needle and the free surface of the liquid. It was now found that the liquid flowed in at a rate of 0.17 ml per minute. The rate increased if the patient moved: the forward and backward bending of the head, in particular, had a marked effect.

An extradural supply of fluid of 0.17 ml per minute is thus possible at the pressure which exists intradurally (100—200 mm of water). From this it follows that, if there is an opening in the dural membrane, leakage will occur so long as the difference in pressure remains and the opening is unclosed:

Some idea of the magnitude of the opening which is necessary, under the given conditions (pressure 110 mm, thickness of the dura 0.3 mm, in order to produce a leakage of the above-mentioned magnitude, can be obtained in accordance with Poiseuille's law. We have here an imaginary circular opening where the diameter is denoted by D . In this case $D = 0.025$ mm.

As indicated by this, the surface of the necessary opening is quite small, whilst those made by our ordinary puncture needles (0.7—0.9 mm in diameter) are certainly much more than sufficient.

An intradural loss of spinal fluid at the rate of 0.17 ml per minute signifies an outflow of 240 ml per 24 hours. The production of fluid is usually estimated at 100—500 ml per 24 hours. Irrespective of which of the figures is correct, a leakage of 240 ml per 24 hours should entail the lowering of the spinal-liquid pressure which is considered to cause the headaches after spinal anaesthesia.

It can be inferred from the above that, if one desires to reduce the frequency of headaches after spinal anaesthesia (and spinal punctures for diagnostic purposes), one should try to reduce the leakage at the puncture opening in the dura.

Various methods for this have been applied. NELSON (1930) bunged up the opening with swelling catgut. HELDT (1929) injected a rubber solution firstly into the opening and secondly extradurally. Both obtained favourable results. ANTONI (1923) began to use thin needles (0.5 mm in diameter) for diagnostic spinal punctures and in 30 punctures had no case of headache. MAXSON (1939) and others have pointed out the importance of the angle at which the point of the needle is held during the perforation of the dura. If the bevelled part is placed at right angles to the longitudinal direction of the dura, several longitudinal fibres in the inelastic dura will be cut off, with diminished prospects of the rapid closing of the opening. If, on the other hand, the bevelled part is held parallel with the direction of the fibres, they will be broken, and a narrow slot-like opening will be obtained, with a greater tendency to contraction.

Fig. 6 shows punctures made by needles with a diameter of 0.5 and 1.0 mm respectively. The needles were held firstly with the bevelled part at right angles to the direction of the fibres, secondly parallel with them. We see that, after parallel placing, merely a relatively small number of dura fibres have been torn off and that, after the removal of the needle, they are tending to



Fig. 1 A.

Puncture opening in
the dura, 2 days old.
Diameter of needle
0.7—0.9 mm.
Magnification 4 \times .
Shows a distinct hole.



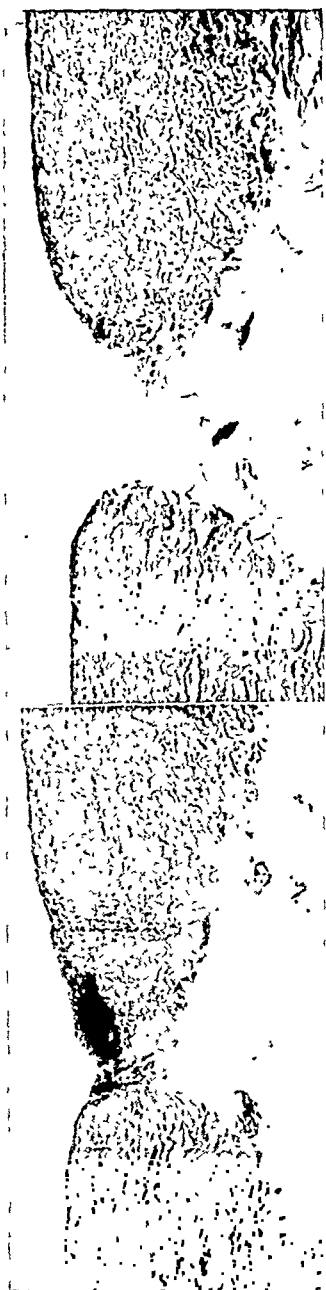
Fig. 1 B.

Magnification 75 \times . Sections from the opening show a normal dura tissue. In one place complete interruption in the continuity (the puncture opening). The edges of the opening show no reaction, whether in the form of inflammatory cells or new formation of connective tissue. (Serial sections of the whole extent of the opening were made.)



Fig. 2 A.

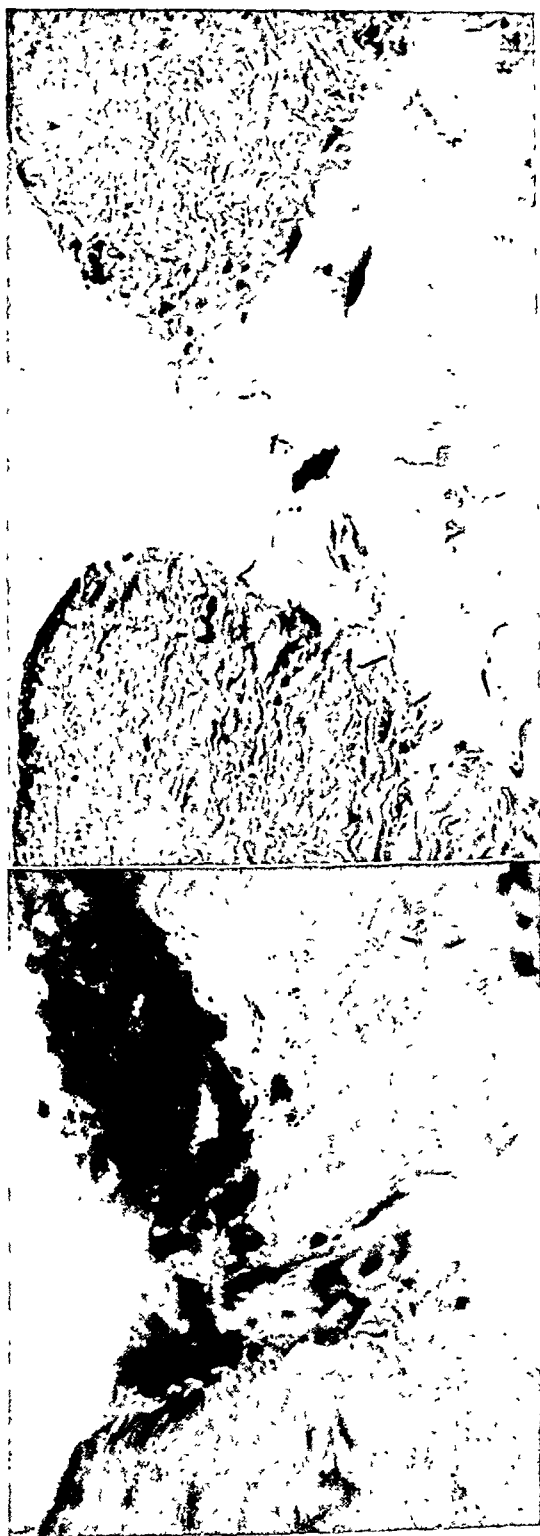
Puncture opening in
the dura, 14 days old.
Diameter of needle
0.7—0.9 mm.
Magnification 4 \times .
Shows a distinct
hole.



Magnification 75 \times . Corner section.

Fig. 2 B.

Magnification 75 \times . Central section.



Magnification of the corner section 350 \times .

Fig. 2 C.

Magnification of the central section 130 \times .

The sections show at the edges (1) isolated lymphocytes and plasma cells and (2) incipient formation of fibroblasts. In the corner sections the fibroblasts show a tendency to bridge over the puncture opening. The pictures indicate healing at an early stage.

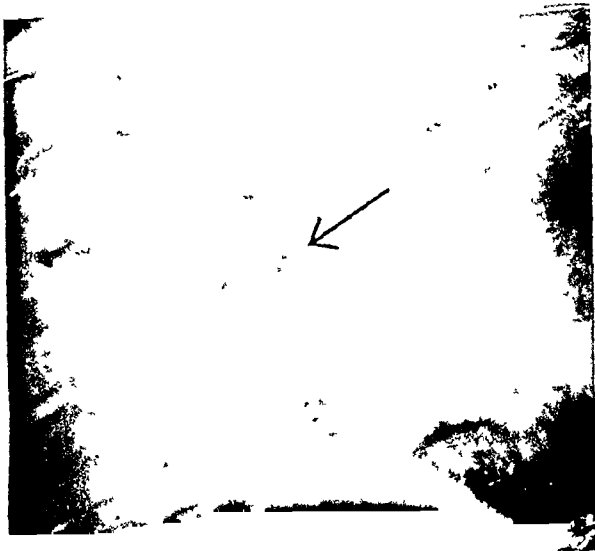


Fig. 3 A.

Puncture opening in the dura,
40 days old.

Diameter of needle 0.7--0.9
mm.

Magnification 4x.

Shows a scar at the place of
the opening.



Fig. 3 B.

Magnification 75x.

A tongue of newly
formed tissue fills the
opening. Serial sec-
tions show that there
is no longer any per-
foration.



Fig. 3 C.

Magnification 150x.

In the old puncture opening, the
contours of which are distinctly
brought out, and which is rather
wide, we see, filling the entire
opening, firstly connective tissue of
recent date, and secondly more
cellular areas, which are taken to
be fibroblast foci. Moreover, we see
in this connective tissue sparsely
lying lymphocytes and plasma cells,
in some places also blood-pigment-
carrying macrophages.

Thus the closure of the opening
has already taken place, but the
closing tissue appears to be of
rather recent date.



Fig. 4 A.

Myelography with oxygen.
Shows how the gas has leaked out epidurally.
The dura is visible as a thin, dark streak.

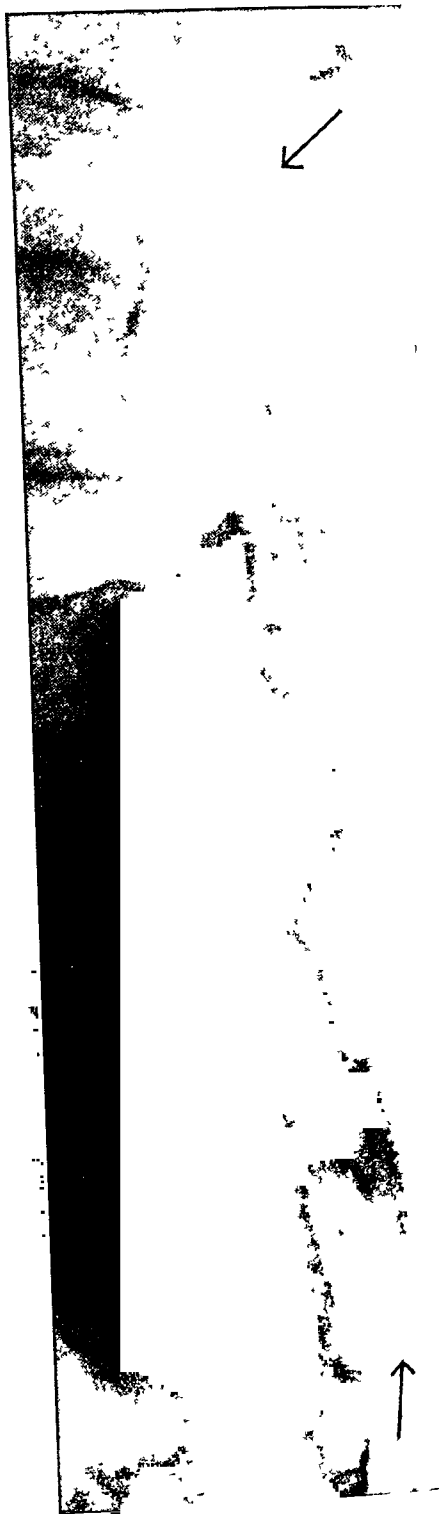


Fig. 4 B.

Myelography with abrodil.
Shows how the liquid has leaked out epidurally. The abrodil is visible as a thin dark streak.
In this case the dural puncture was made accidentally with the "introducer".



Diameter of needle 0.5 mm. Sections in the plane of the dura. Magnification 75 \times .

A. The beveling of the needle parallel with the longitudinal direction of the dura fibres.

B. The beveling of the needle at right angles to the longitudinal direction of the dura fibres.



Diameter of needle 1.0 mm. Sections in the plane of the dura. Magnification 75 \times .

C. The beveling of the needle parallel with the longitudinal direction of the dura fibres.

D. The beveling of the needle at right angles to the longitudinal direction of the dura fibres.

Fig. 6. Puncture opening in the dura.

recover their original position. If the broken fibres are counted, it will be found that the number when the needle had been held at right angles is about twice as large as when it had been placed parallel. We also find that the number of torn-off fibres is directly proportional to the diameter of the needle.

Example:

Diameter	1.0 mm	Bevelling	at right angles	Ca.	150 fibres	torn off
»	1.0	»	parallel	»	90	»
»	0.5	»	at right angles	»	80	»
»	0.5	»	parallel	»	45	»

The diameter of the needle affects the size of the opening also by the fact that, with a thicker needle, the breaking of the fibres extends over a larger area. From this it may be inferred that a relatively small opening is produced by a needle 0.5 mm in diameter, and especially if the bevelling is placed parallel with the longitudinal direction of the dura fibres.

As previously pointed out, the usual headache after spinal anesthesia is caused by the reduced pressure of the spinal fluid in the dural membrane. This, in turn, may be due to changes in the production and resorption or leakage of fluid.

Changes in production and resorption may be caused by irritation of the tissues during the anesthesia. This effect, however, seems to be rather slight, as, according to several investigators, the usual signs of such irritation, namely the increase of cells and protein in the fluid, are insignificant and show but little parallelism with the headache. — As indicated above, various anesthetics have been tested in order to produce less irritation, and none has been found that is markedly better than the others. Decicain, however, is relatively favourable. — The mere introduction of a needle into the dural membrane, of course, also causes certain reactions. They seem to be less marked when a thin needle has been used.

Leakage of fluid of such magnitude and duration that it can cause the fatal reduction of pressure has been mentioned above. A finer needle entails a smaller and less protracted leakage.

Setting out from these facts and, in order to obtain a form of spinal anesthesia where the complications and especially the headaches have been reduced to a minimum, GORDH has elaborated a method for low and medium-high spinal anesthesia, where the relatively favourable heavy Decicain (specif. gravity 1.040) is injected with a fine needle (0.5 mm in diameter).

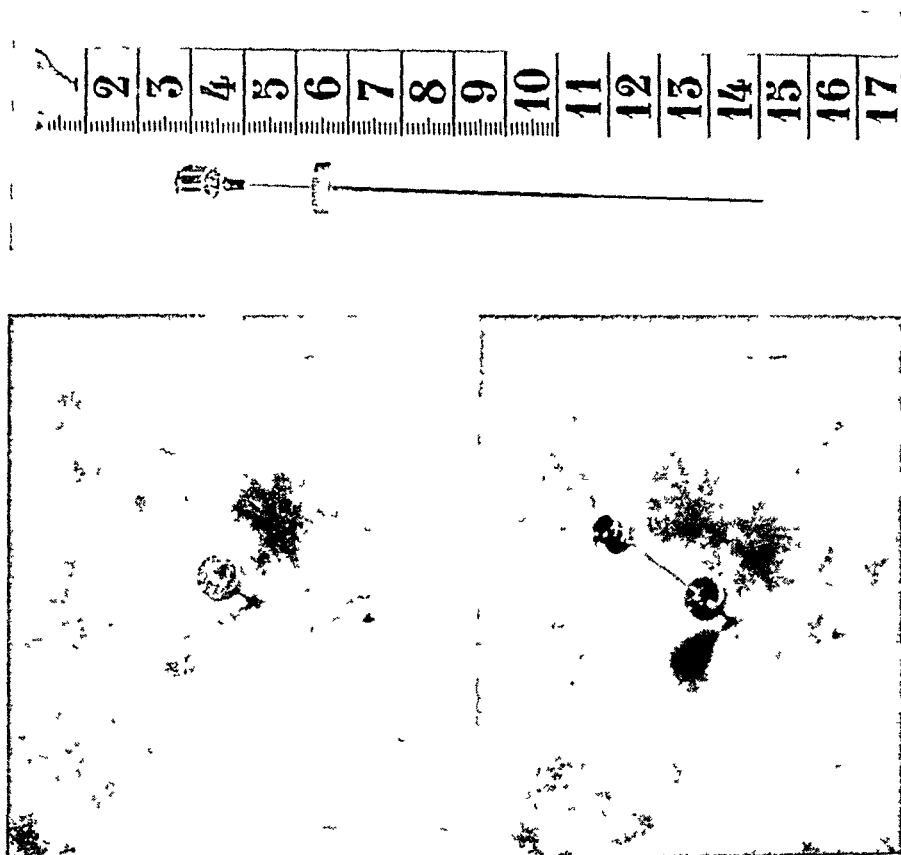


Fig. 7.

Set of instruments (puncture needle and "introducer"). Above it, a cm measure. The "introducer" inserted.

The puncture needle has perforated the dural membrane. A drop of fluid can be discerned.

The technique adopted for the puncture in these anesthetics essentially corresponds with that indicated by ANTONI (1923) for diagnostic spinal punctures. Needles with a diameter down towards 0.5 mm are so weak that it is difficult to force them through the skin and ligaments. This difficulty is eliminated, in ANTONI's procedure, by inserting an "introducer" through the skin and ligaments. With the aid of this "introducer" the fine needle is inserted and perforates the dura.

Our set of instruments¹ (Fig. 7) consists of an ordinary puncture needle, 0.5×110 mm, and an "introducer", 1×50 mm, pro-

¹ The set of instruments is sold by KIFA, Stockholm, under the designation *spinal puncture needle with introducer* (Antoni-Sise).

vided with a strong flange at the base, which makes it easily manipulated. This "introducer" was designed by SISE (1928).

In practice, the anesthesia is carried out in the following manner. The patient is caused to sit or lie with back bent so far as possible. The skin is disinfected with iodine spirit. A skin wheal is made with a $1\frac{1}{2}$ % solution of etocain. The "introducer" is inserted in the interspinal ligament so that it is firmly fixed. The fine needle is cleansed and is then inserted in the "introducer". A hanging drop is applied, after which the needle is slowly pushed in. The usually occurring extradural negative pressure is seldom able to suck in the hanging drop. Nor does one always feel the usual perforation sensation of the dura: at the next moment the hanging drop is observed to fall. The rate of the dropping from the fine needle is very slow, one drop every 10—15th second. The anesthetic is injected in the usual way, whereupon the fine needle is first removed and afterwards the "introducer", as in this way the least injury to the dura is caused. The anesthesia is then performed in the usual way. — One drawback with the fine needle is that the lumen sometimes gets bunged up when it is introduced. In that case a new needle must be used. — Otherwise this technique, after some practice, is quite as easy as that with the thicker needle.

Low and medium-high spinal anesthesia as above described were carried out in 100 cases (see Table 2). After the operation, no restrictions in regard to position or liberty of movement were prescribed. 16 % of the patients got up on the same day as the operation, some of them actually walked away from the operation table. The others lay in bed in the usual way, with the head high, and were allowed to move at will. In none of these 100 cases did headache occur. Nor have other complications been observed.

The principal sequel of spinal anesthesia, headache, has been very considerably reduced by the above-described procedure. The range of indication for this form of anesthesia, which in recent years has been rather narrow in view of the risk of headache, might thus again be extended. As it is evidently possible for the patient to get up immediately after the operation, the method should be adapted also for the out-patient department. Especially in low spinal anesthesia for minor and simple operations, such as cystoscopy, operation of hemorrhoids, or the like, headache is an unnecessary complication and, if it could be avoided with this special technique, much would be gained.

Table 2.

Distribution of the patients according to age and day of getting up after low and medium-high spinal anesthesia with *heavy decicain* and a *fine needle* (0.5 mm in diameter).

Day of getting-up Age	Op.	1.	2.	3.	4.	5.	6.	7.	Others	Total
< 20	1		2		2				2	7
20-29	7	4	3	3		2	2	2	12	35
30-39		4		1			1		4	10
40-49	3	4	2	1		1			5	16
50-59	1	5	1	2	3				5	17
60-69	4	2			2				2	10
70-79		1	1		1				1	4
80-89		1								1
90-99										
	16	21	9	7	8	3	3	2	31	100

16 % of the patients got up on the day of the operation, 21 % on the day after. 48 % were above the age of 40. 4 % were women.

Summary.

The frequency and cause of post spinal headache is studied.

In a series of 362 consecutive cases of low spinal anesthesia headache occurred in 13 %. Etocain solution of 5 % was used and the diameter of the needle varied between 0.7 and 1.0 mm. Leakage of cerebro-spinal fluid into the epidural space is thought to be the main contributing factor. In autopsy cases the dural puncture opening is shown to be open for two weeks and longer.

The leakage is minimized by using a fine needle (a special needle with introducer, called Antoni-Sise needle) of 0.5 mm diameter. In 100 consecutive cases of low spinal anesthesia with this needle and using "heavy Decicain" (pontocain-glucose with specific gravity of 1.040) no case of headache was recorded. No prophylactic measures as to position were made and 16 % were getting up on the operation day, and some were walking from the operation table. This more delicate technique is considered worth while.

Zusammenfassung.

Die Häufigkeit und die Ursache der nach Spinalanästhesie auftretenden Kopfschmerzen sind Gegenstand der Untersuchung.

In 362 aufeinander folgenden Fällen von Lumbalanästhesie traten Kopfschmerzen bei 13 % auf. Es gelangte 5 %-ige Etokainlösung zur Anwendung und der Durchmesser der Nadel variierte zwischen 0.7 und 1.0 mm. Es sind angenommen, dass ein Durchsickern von cerebro-spinaler Flüssigkeit in den Epiduralraum der Hauptgrund für die Beschwerden ist. Es zeigte sich an Sektionsfällen, dass die Punktionsöffnung zwei Wochen und länger offen blieb.

Durch Gebrauch einer feinen Nadel (Spezialnadel mit Einführung, sogenannte Antoni-Sise-Nadel) mit 0.5 mm Durchmesser ist das Durchsickern auf ein Minimum reduziert. In 100 aufeinander-folgenden Fällen von Lumbalanästhesie wurde bei Anwendung dieser Nadel und Verwendung von »schweren Decicain« (Pantocain-Glukose, spez. Gew. 1.040) kein Fall von Kopfschmerzen beobachtet. Keine prophylaktischen Massnahmen hinsichtlich der Lage wurden getroffen und 16 % standen am Operationsstage auf und einige gingen selbst vom Operationstisch. Diese etwas sorgsame Technik kann als lohnend angesehen werden.

Résumé.

L'auteur étudie la fréquence et la cause des céphalées après injection intrarachidienne.

Dans une série de 362 cas consecutifs de rachianesthésie lombaire, la céphalée est apparue dans 13 % des cas. Une solution d'Etocaïne avait été utilisée et le diamètre de l'aiguille variait entre 0.7 et 1.0 mm. L'auteur pense que la filtration du liquide céphalo-rachidien dans l'espace epidural constitue le principal facteur. Dans les cas autopsiés l'orifice de ponction au niveau de la dure-mère reste béant deux semaines et plus.

La filtration est rendue minime par l'utilisation d'une aiguille fine (aiguille spéciale munie d'un mandrin, appelée aiguille Antoni-Sise) de 0.5 mm de diamètre. Dans 100 cas consécutifs de rachianesthésie lombaire pratiquée avec cette aiguille et une solution de «Decicaïne lourde» (pantocaïne-glucose de poids spé-

cifique 1.040) aucun cas de céphalée ne fut noté. Aucune mesure prophylactique concernant la position du malade ne fut prise, 16 % des patients se levèrent le jour de l'opération et quelques uns marchèrent à la descente de la table d'opération.

Cette technique plus fine semble digne d'intérêt.

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On Dislocation and Fracture-Dislocation of the Spinal Column.¹

By

R. INGEBRIGTSEN.

The origin of the views to be advocated here with regard to the treatment of fracture-dislocations of the spinal column are of a rather old date, as a matter of fact from 1932, when I received for treatment a male, 28 years of age, who was admitted into the Surgical Department B. on August 31st 1932.

Case 1. The facts of the case are the following: He was sitting beneath a bus to repair this, when suddenly it started rolling backwards. The man was hit over the back of the neck by the exhaust pipe and crumpled forward, until he heard a crunching of the spine. He lost consciousness, and when he came to, both his legs were paralysed.

The accident happened on August 31st 1932, and he was admitted into my department on the same day. The following findings were made: Total paralysis of both legs, paralysis of the bladder and of the rectum. Loss of patellar reflexes, Achilles tendon reflexes and plantar reflexes, while the abdominal reflexes were present.

On examination for all forms of sensation impairment was found from the groin to the knees and total anesthesia also for all forms from the knees to the toes.

On examination of the spine were found: angular kyphosis in the transition between the thoracic and the lumbar region and great tenderness of the spinous processes of the eleventh and twelfth thoracic vertebrae.

Roentgenogram (The University Clinic X-ray Department) demonstrated: "Compression fracture of the body of the twelfth thoracic vertebra with wedge-shaped anterior attenuation and posterior subluxation in correlation to the vertebra lying above. Corresponding to this are found: kyphosis and a slight right-sided scoliosis. The twelfth rib

¹ The paper was read at the meeting of the Norwegian Surg. Society Sept. 1945.

on the right side also is fractured close to the spine. X-ray diagnosis: "Fracture of the spine." (Fig. 1.)

The following day I saw the patient and interpreted the roentgenograms as complete fracture-dislocation between the eleventh and twelfth thoracic vertebrae. The eleventh thoracic vertebra was dislocated 1 cm anteriorly in relation to the twelfth thoracic vertebra below. On this dislocation depended a considerable attenuation of the spinal canal.

Twenty-four hours after the injury I performed under local anesthesia *open reduction*.

The site of the fracture is exposed by longitudinal incision. The interspinous ligament and the ligamenta flava between the eleventh and twelfth thoracic vertebrae are ruptured, and there is considerable hemorrhagic infiltration of the musculature. After resection of the spinous processes of the eleventh and twelfth thoracic vertebrae it becomes apparent, that both articular processes of the twelfth thoracic vertebra lie *behind* the articular processes of the eleventh thoracic vertebra above. Thus complete dislocation is present, but there is no fracture of the arches or of the articular processes. With the aid of a couple of strong hooks inserted under the arch of the eleventh thoracic vertebra it was possible to elevate this slowly upward and pull it backward so that the articular processes of the eleventh thoracic vertebra resumed their place behind the corresponding articular processes of the twelfth thoracic vertebra.

After closure of the wound the patient was put in extreme reclinatio into a plaster of Paris bed, prepared beforehand.

A roentgenogram taken after the intervention demonstrated how the compression of the body of the vertebra had become reduced and how the alignment of the eleventh and twelfth vertebrae had been restored. (Fig. 2.) On the ninth day after the reduction the patient passed the urine spontaneously, and subsequently had no difficulties in this respect.

On the twenty-third day after the operation he was able to move the toes of both feet, and it was now possible to elicit the plantar reflexes on the right side, inverted.

The mobility in his lower extremities improved slowly, as also the sensation.

Two months after the reduction there was hypoaesthesia from the middle of the legs to the toes. Now he was able to lift the *left* leg from the bed with straightened knee and was able to move somewhat in all joints of the right leg.

Two and a half months after reduction he was allowed out of bed, and he was discharged on January 24th 1933, which is to say approximately five months after the injury. He was now *able to walk with two canes*, and was able also to walk upstairs. Moved in all joints except to the dorsal side of the foot joint. The patellar and Achilles tendon reflexes were greatly exaggerated, ankle clonus of both feet.

Hypoaesthesia for all forms of sensation from the middle of the legs to the toes.

With certain intervals I examined the patient on behalf of the Public Insurance Institution, last in 1938. The following findings were made: He walks well, but the gait is spastic. He was not able to step up on his toes, and neither to jump on either leg. The mobility of the spinal column completely free. Free mobility in the hip joint. Normal position of the knees, flexes 110 degrees. Normal position of foot joints. Moves toward the dorsal side 10 degrees (10 degrees) and toward the plantar side 30 degrees (30 degrees). Both feet show free pronation and supination. The patellar reflexes are greatly exaggerated, on the left side: patellar clonus. The plantar reflexes on both feet are inverted.

Application in writing in March 1945 brought information from the patient to the effect, that he is still stiff in the legs and has some difficulties in walking and in carrying heavy articles. He is working, however, as chauffeur 10—12 hours daily and earns 75 crowns a week.

In the light of the result obtained in this case it is logical, and a matter of course, to claim, that the ideal treatment of dislocations and fracture-dislocations of the spinal column, as in the body otherwise, is reduction as speedily as possible, and as there are no prospects of closed reduction succeeding in the thoracolumbar region the open method is the sole resource. This was not the common and correct belief, however, in 1932, and neither is it to this day.

Pure dislocations of the spinal column occur practically speaking only in the cervical region. Fracture-dislocations also occur most frequently here, though occasionally also below this region, and then most frequently in the transition between the thoracic and the lumbar regions. Even though it may be admitted that there is a difference, of course, between pure dislocations and fracture-dislocations in pathological-anatomical and clinical respect, I am still of the opinion, that these two types of lesions are so closely related from a *therapeutical* point of view, that they may as well be regarded jointly. The dominating feature, common to dislocation as well as fracture-dislocation is the inverted relation between the articular processes. In the usual anterior dislocation of the uppermost vertebra the articular processes of the dislocated vertebra have slipped up and have become hooked up in front of the articular processes of the vertebra below. In respect of the treatment this is a domineering trait of the picture. If this dislocation is complicated with a fracture, this may give a different, and in certain cases poorer prognosis. All that we have learnt, however, in recent years with regard to treatment of the uncomplicated compression fracture, and the disagreement which may

exist among surgeons as to the treatment of such fractures, cannot modify the indications for treatment of the dislocation. The ideal procedure here is the speediest possible reduction of the dislocation, whether or not it is complicated by a fracture.

The cases of this kind which the individual surgeon receives for treatment are few and far between, and here, if ever, it is of material importance, therefore, to learn also from the experience of others. It will be of interest to investigate how the conceptions with regard to the treatment of dislocations and fracture-dislocations have developed in the course of the past decades.

In 1909 the problem of surgical intervention in traumatic lesions of the spinal cord and the vertebral column was the chief subject at the congress of French surgeons. The opinion of these cases at the time was rather pessimistic, expectant. The introductory lecturer (SENCERT) recommended immediate closed reduction for dislocations of the cervical spine, but if the seat of the dislocation is farther down, he wished to wait and see. WILLEMS related three cases of dislocation of the spinal column with paraplegia, operated on immediately by open reduction with laminectomy. All three patients died shortly after the intervention. — Otherwise some cases of laminectomy are reported which have been performed to alleviate compression symptoms.

The following year HILL reported a case of lesion of the spinal column and the spinal cord. On the fourth day after the injury laminectomy was performed of the seventh cervical vertebra and the first thoracic vertebra, and a previously non-diagnosed forward dislocation of the sixth cervical vertebra was reduced. Instant improvement, and then gradual restitution of the complete paraplegia. In 1911 DE QUERVAIN recommended immediate operation for irreducible dislocations and fracture-dislocations with partial lesion of the spinal cord.

In 1914 BORCHARD treated a complete forward dislocation of the first lumbar vertebra without transverse lesion, with the open method of reduction twenty-four hours after the injury. Result: complete recovery.

In 1918 FRAZIER has collected from the literature for the preceding five years 44 cases of dislocation of the cervical spine. In 31 of the 44 cases of dislocation transverse lesion was found, in nine of which complete, with six deaths, and in twenty-two incomplete. Thus lesion of the spinal cord is present in three-fourths of the cases, and FRAZIER has found that the risk of such

lesion is greatest at the level represented by the fifth and sixth cervical vertebrae.

FRAZIER further has collected 86 cases of fracture-dislocations of the spinal column, 43 of which in the cervical region, 27 in the thoracic and 16 in the lumbar region. 32 had complete transverse lesion, 26 partial transverse lesion, and 5 had symptoms of compression of the nerve roots. In 20 cases no neurological symptoms were present, in 3 cases no mention was made of this.

FRAZIER also has investigated the treatment applied in the 44 cases of dislocation, and the results achieved. Only two of the 44 patients had been operated on immediately (open reduction), the one making a complete recovery, the other dying. Six patients were operated on at a later stage after the injury. Of these one made a complete recovery, five being improved. Of the 41 cases which were not operated on 7 recovered, 22 improved, and 6 terminated fatally.

FRAZIER personally has no operatively treated cases of dislocation in the spinal column. He agrees, however, with BORCHARD who recommends immediate open reduction.

In 1925 RANZI and VOGEL describe two patients with dislocation and fracture-dislocation in the spinal column with total transverse lesion, which were treated with laminectomy and reduction. The one patient operated on under ether narcosis died one week after the operation. Post mortem examination demonstrated complete crushing of the cervical cord and bilateral pneumonia. The other patient, operated on under local anesthesia, died two days after the operation. Before dying he was able to move the toes. The post mortem examination disclosed red softening of the cervical cord and lobar pneumonia.

Then the surgery of the spinal column was the main subject at the Congress of Surgeons in Berlin in 1930. In the introductory lecturer's collected material of 242 cases of vertebral dislocations 18 cases only were reduced by the open method, half of which died, 21.5 per cent were unaffected by the intervention, and 28.5 per cent were cured. The introductory lecturer (SCHMIEDEN) draws the conclusion with regard to total fracture-dislocations, that open reduction is absolutely contraindicated in all stages, and generally in all cases showing definite transverse lesion. This opinion was not contradicted at the congress.

BÖHLER makes the remark, in his text-book from 1932, that fracture-dislocations should be reduced by the open method.

In 1937 WENZL has collected from the literature the cases of dislocation — a total of 59 — which were associated with grave neurological disturbances. 29 of these cases have not been reduced, 7 of them showed inconsequential improvement, and 21 died. 10 of the 30 reduced cases were completely cured, and for 18 cases the result was satisfactory. WENZL has personally in 4 cases of dislocation and fracture-dislocation treated with open reduction obtained complete recovery in one case, very good result in one case, and considerable improvement in two cases, in one of which a complete transverse lesion was present. WENZL strongly advocates immediate open reduction for dislocations in the spinal column, and warns against so-called conservative treatment, against laminectomy, and also against extension.

It thus appears that in the past 30—35 years the open reduction slowly, but fairly definitely, has obtained a greater place in the treatment of dislocations and fracture-dislocations of the spinal column. As late as in 1945, however, BUSCH in his excellent text-book on the traumatology of the nervous system has warned against open reduction in cases with total transverse lesion. In such cases, he states, there is never indication for open reduction. In the case of incomplete transverse lesion he would be reserved with regard to reduction, but tries it all the same, possibly combined with a laminectomy.

In the course of the 13 years which have elapsed since the above mentioned patient, I have treated three cases of recent dislocation and fracture-dislocation of the cervical spine, all of which had complete transverse lesion — by open reduction.

I shall give a brief reference of the history of these patients and of the result of the treatment.

Case 2. T. E. 40-year-old male. Admitted into Surgical Department B. on February 10. 1935. Four days prior to the admission he fell off a sleigh loaded with hay while driving downhill, and was dragged along holding on to the reins. The head was jammed between the sleigh and a stone, and he heard a crunching in the back of the neck. He was admitted the same day into the local county hospital, and was referred to my department four days later.

On admission was found: Slack paralysis of both legs and of the abdominal muscles. The arms slightly paretic. Loss of the tendon reflexes of both legs, and the abdominal reflexes absent. In the arms the tendon reflexes are normal.

Sensation: Loss of sensation of pain and temperature from the second rib to the toes. Sensation of touch intact. Paralysis of the bladder.

X-ray examination showed fracture-dislocation of the cervical spine, the sixth cervical vertebra being dislocated forward. Anteriorly on the body of the seventh vertebra there is a triangular tear fracture, as also fracture of the arch of the sixth cervical vertebra, the posterior fragment having kept its original position and not come forward. (Fig. 3.)

The patient was operated on the day after admission under local anesthesia. The spinal process of the sixth cervical vertebra has become mobilized due to fracture through the arch of the sixth cervical vertebra on both sides. After exposure of the articular processes on both sides complete dislocation is found. Under guidance of the sight and with application of strong hooks reduction is made first on one side and then on the other without use of particularly great force.

After the operation he had increasing temperature and respiratory trouble. He was unable to expectorate, and died four days after admission.

Post mortem examination demonstrated bronchitis and incipient pneumonia.

In the cervical column was found dislocation between the sixth and seventh cervical vertebrae, reduced, some epidural hemorrhage at the site of the lesion from the first cervical to the first thoracic vertebra. No hemorrhage under the dura. The cord was soft and swollen in an area 1 cm long corresponding to the site of the dislocation, where the substance is soft, so that it oozes out. Further, reddish brown colour around the posterior grey horns to an extent of 2—3 cm. The white substance was comparatively little softened around the hemorrhage.

Case 3. K. K. 46-year-old male. Admitted into Surgical Department B. on October 28. 1935. On the day of admission he had fallen on his back out of a waggon driving at full speed, hitting the back of his head and neck against the ground. He got severe pain in the neck.

On admission free mobility was found in the upper extremities but greatly reduced power. Complete slack paralysis of the trunk and of both legs.

Reflexes: Abdominal reflexes and deep reflexes absent in both legs. Loss of sensation for all forms from the jugulum to the toes. Paralysis of the bladder.

X-ray examination demonstrated forward dislocation of the sixth cervical vertebra. Some small parts have been torn off the lower edge of the sixth cervical vertebra, as also fracture of the spinous processes on the sixth cervical vertebra. (Fig. 4.)

On the day of admission open reduction was performed under local anesthesia. After exposing the arch of the seventh cervical vertebra the articular processes are seen with their cartilaginous surface standing behind the articular processes of the sixth cervical vertebra. With moderate traction on the head and under guidance of the sight reduction is made by hooks first on the right side, then on the left. Thereupon the patient was put in a plaster of Paris bed.

The following days the respiration was occasionally superficial and irregular. The temperature increased. No change in his paralysis occurred, but dullness and impaired respiration on both posterior surfaces. He died three weeks after admission.

Post mortem examination proved the articular processes to be in position. On removal of the cord this was found to be practically flattened out corresponding to the site of the dislocation. The cord was examined after fixation. Corresponding to the compressed region was found a transverse, 1 cm long slit surrounded by a brownish red, hemorrhagic area, particularly posteriorly. The cord here was flat and soft.

The part below the compressed region is also flat and soft to an extent of 2—3 cm, crushed, and with completely effaced markings. Below this area at a distance of 6 cm hemorrhage is seen in the grey substance on the one side.

Above the compressed area the cord was soft, crushed and greatly swollen, to an extent of 2 cm. Above this the markings were very indistinct. The cord was soft and pale to an extent of 2 cm.

Further, the oblong marrow with surroundings was examined. No macroscopical signs of hemorrhage or softened parts anywhere.

Besides these extensive changes in the cord the patient had an embolus in the pulmonary artery with a hemorrhagic infarct.

Case 4. K. S. 27-year-old male, admitted into Surgical Department B. on June 22. 1941. During training in a swing-pole (the giant swing) he lost his grip and fell down on the back of his neck.

On admission into the department soon after he complained of troubled respiration. Complete slack paralysis from the second interspace all the way down with respiratory depressions in the interspaces. Greatly reduced mobility of arms and fingers. Loss of sensation for all forms from the fourth rib. Reduced sensation on the medial side of both feet. Loss of reflexes in the abdomen and the lower extremities, but preserved, not inverted, plantar reflexes.

X-ray examination demonstrates forward dislocation of the fifth cervical vertebra and compression fracture of the sixth cervical vertebra. (Fig. 5.)

Open reduction was performed immediately under local anesthesia. It was carried out with the aid of hooks and under guidance of the sight. Moderate traction was exerted on the head. The patient succumbed the following day. Post mortem examination was not carried out.

In these three cases with transverse lesion of the cord the intervention was of no use, and the post mortem examination in two of them demonstrated complete traumatic destruction of the cord.

In my department we have treated two more patients — one with partial transverse lesion (lesion of the pyramidal tract), and the other with neurological disturbances.

Case 5. A 50-year-old male on October 15, 1944 was hit in the back of the neck by a falling ladder. He lost consciousness, was unable to get up, and had severe pain in the shoulders and the right arm. He was admitted into a nearby hospital four days later. Here he was treated first with Glisson's sling. An attempt was made at closed reduction 13 days after the injury, and at open reduction 20 days after the injury, without reposition being effected of the dislocation, demonstrated roentgenologically between the fifth and sixth cervical vertebrae. He was admitted into the Surgical Department B. on November 25, 1944. The urination has been in order. He was free from pain. At the back of the neck the spinous processes of the seventh cervical vertebra projected greatly.

The abdominal reflexes were absent, greatly exaggerated patellar and Achilles tendon reflexes. The plantar reflexes were inverted.

No active mobility in the fingers and wrist of the right hand. The supination also greatly reduced. Also in the left hand incomplete flexion of the fingers and greatly reduced power by all movements. Severe muscular atrophy of both upper extremities.

The right leg lies rotated 75 degrees outward in the hip. No mobility in the ankle joint. Just visible mobility in the toes. With straightened knee he is able to lift the leg a little from the bed, but it falls down again at once. *The left leg:* Normal position and fairly good mobility in all joints.

There is atrophy of both lower extremities with considerable rigidity and retardation.

Slightly reduced tactile sensation of the right hand and forearm. Otherwise nothing.

X-ray examination demonstrated complete forward dislocation of the fifth cervical vertebra. The upper anterior corner of the sixth cervical vertebra is slightly rounded. (Fig. 6.)

Two days after admission *direct extension* on the head was applied, 5 kg, which was increased rapidly in the course of one week to 15 kg. During this treatment the position became somewhat changed. (Fig. 7.) Reduction, however, could not be effected, and the patient was *operated on, therefore, on December 9, i. e. 55 days after the injury, under local anesthesia.*

The articular processes of the fifth cervical vertebra were hooked below and in front of the articular processes of the sixth cervical vertebra on both sides, and there were immense fibrous cicatricial masses surrounding these. After having exposed the bone it was possible with the aid of a couple of hooks and an elevator to disengage the articular processes of the fifth cervical vertebra, and lifting them over the edge of the articular processes of the sixth cervical vertebra, first on the one hand and then on the other side, and by flexing the head far backward the articular surfaces slid into place. The wound was closed and the patient was put into a plaster of Paris bed prepared beforehand, with the head in major reclinatio.

There was very little reaction on the intervention. Rapid improvement of the mobility. He was up on January 13, which is to say

approximately 4 weeks after the operation, and was discharged on February 8, exactly two months after the operation. He was then able to walk slowly and carefully, dragged the right foot a little. He was able to move the arm in the right shoulder outward upward and anteriorly upward 90 degrees (150 degrees). Greatly exaggerated tendon reflexes still persisted on both legs, and inverted plantar reflexes.

Free mobility of the fingers apart from a slight flexion contraction of the fingers of the right hand.

The X-ray examination demonstrated complete reduction of the dislocation.¹ (Fig. 8.)

Case 6. H. G., a 32-year-old, powerful male, dived on July 18, 1945 from a 1 metre height into a pond approximately 1 metre deep. He got severe pain in the neck and a feeling of numbness and pain in the left shoulder and arm. Since then he has not worked, but has been up.

He was admitted into my department two weeks later. Some restriction was found of the turning of the head, but not of the bending of the head. No disturbances of the mobility, and neither any other neurological disturbances.

X-ray examination (Fig. 9) revealed that the body of the fifth cervical vertebra had glided $\frac{1}{2}$ cm forward in relation to the sixth cervical vertebra. For further study of details so-called section photography or planigraphy was performed by doctor J. TORGENSEN, and this demonstrated that the articular process on the right side was in position. (Fig. 10.) The articular process on the left side, however, showed complete dislocation. Already this is sufficient to explain the significance of the planigraphy for the interpretation of such cases.

The patient now was treated with direct extension on the head, which was applied on August 7., 15 kg. He had this for 10–11 days, and X-ray examination before the traction was removed demonstrated this picture. (Fig. 11.)

Then a plaster cast was applied on head, neck and chest with the head somewhat reclined, and he was discharged with this.

Two weeks later he was readmitted, and a roentgenogram now revealed that there was a fresh dislocation with $\frac{1}{2}$ cm forward displacement of the fifth cervical vertebra. On the other hand there was practically no dislocation corresponding to the articular processes in this roentgenogram, which was identical to the X-ray picture in fig. 9. Also on this occasion the planigraphy supplied valuable help to explain the position. The articular processes on the right side are placed normally in relation to each other, only with a slight slipping upward between the fifth and sixth. On the left side, however, there is forward dislocation of the articular processes of the fifth lumbar vertebra as compared to the sixth cervical vertebra. Further,

¹ From the patient I have just received a letter written by himself (right hand). 14 months after the operation. His left hand and leg are completely restored. With his right hand he can handle different working-tools, he writes well — just as before. The right knee feels a little stiff, but he has recently in one day performed a march of 12 km without difficulty.



Fig. 1. Case 1. The fracture dislocation of the X11th—X12th thoracic vertebra is evident in the upper part of the picture.



Fig. 2. Case 1. The fracture-dislocation of the X11th—X12th thoracic vertebra is reduced.



Fig. 3. Case 2. Fracture of the arch of the V11th cervical vertebra and complete fracture-dislocation of the V11th—V12th cervical vertebra.



Fig. 4. Case 3. Complete fracture-dislocation of the VIth—VIIth cervical vertebra.



Fig. 5. Case 4. Complete fracture-dislocation of the VIth—VIIth cervical vertebra.

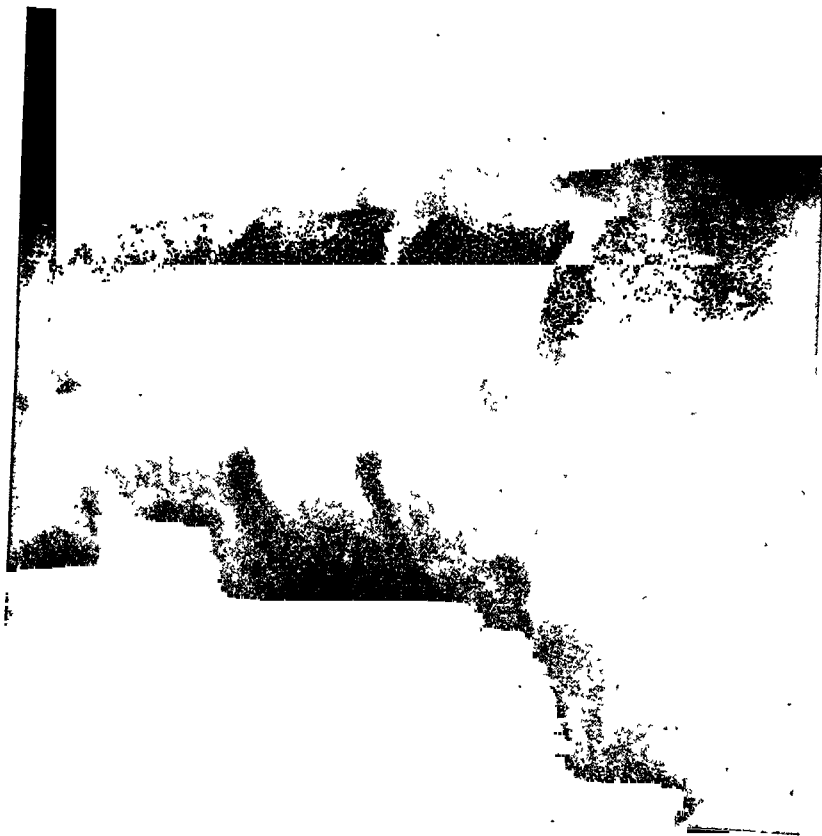


Fig. 6. Case 5. Complete fracture-dislocation of the Vth—VIth cervical vertebra.

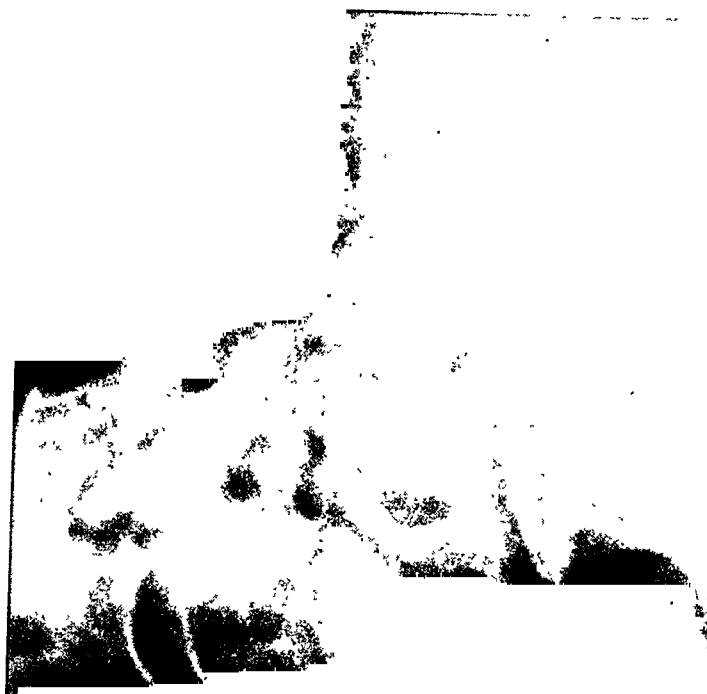


Fig. 7. Case 5. Complete fracture-dislocation of the Vth—VIth cervical vertebra having been treated for 10 days by direct extension on the skull; there is no reduction.



Fig. 8. Case 5. Complete fracture dislocation of the Vth--VIth cervical vertebra treated by open reduction 55 days after the accident.



Fig. 9. Case 6. Unilateral fracture luxation Vth--VIth cervical vertebra. Articular processes are in place in this picture.

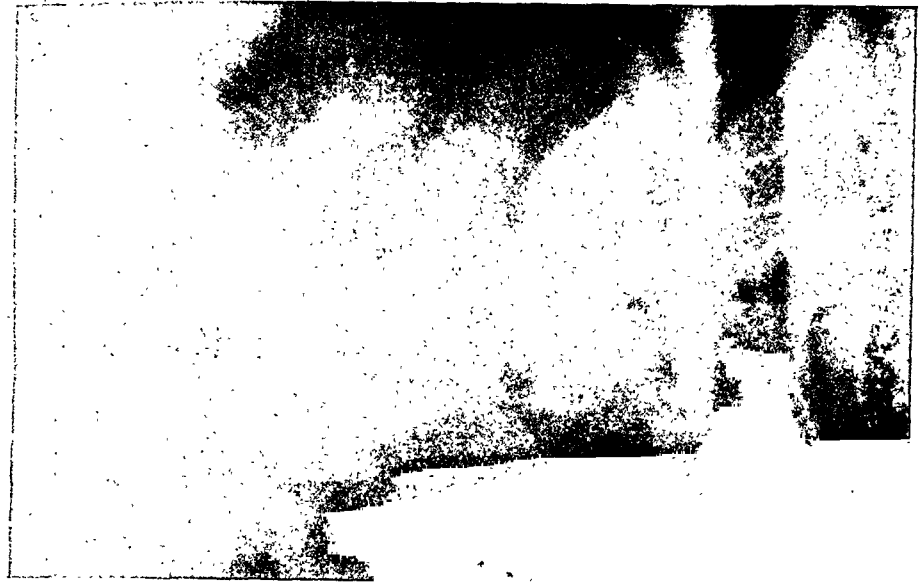


Fig. 11. Case 6. X-ray picture after 10 days of skull traction.

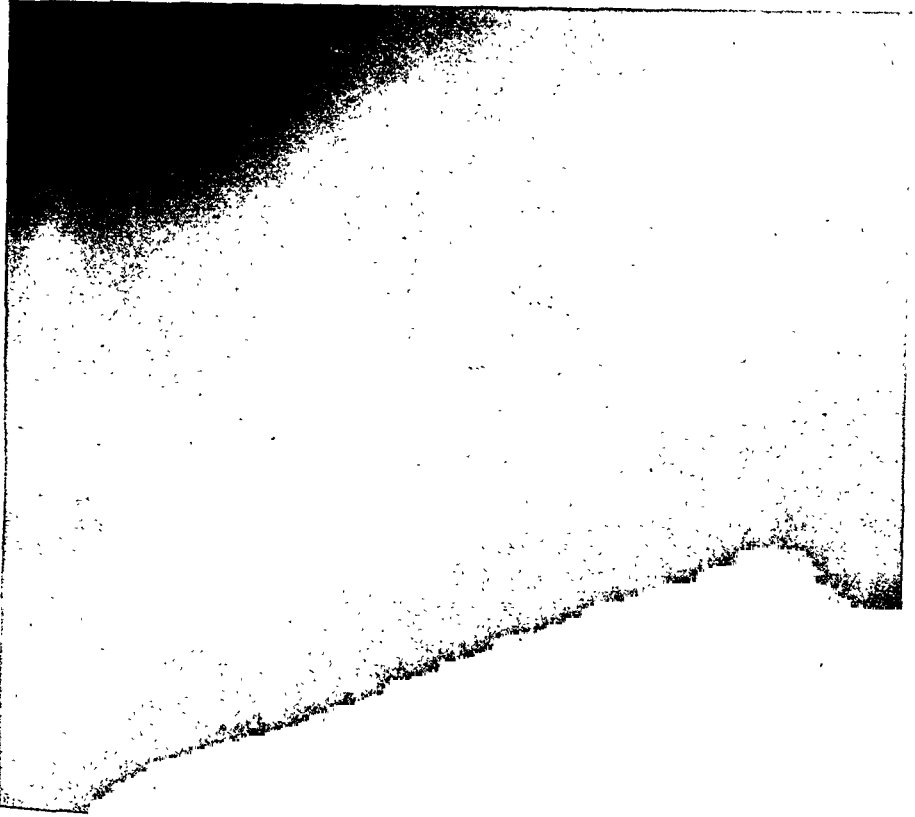


Fig. 10. Case 6. On admission. Planigram showing the right articular processes in place.

INGEBRIGTSEN: Dislocation of the Spinal Column.

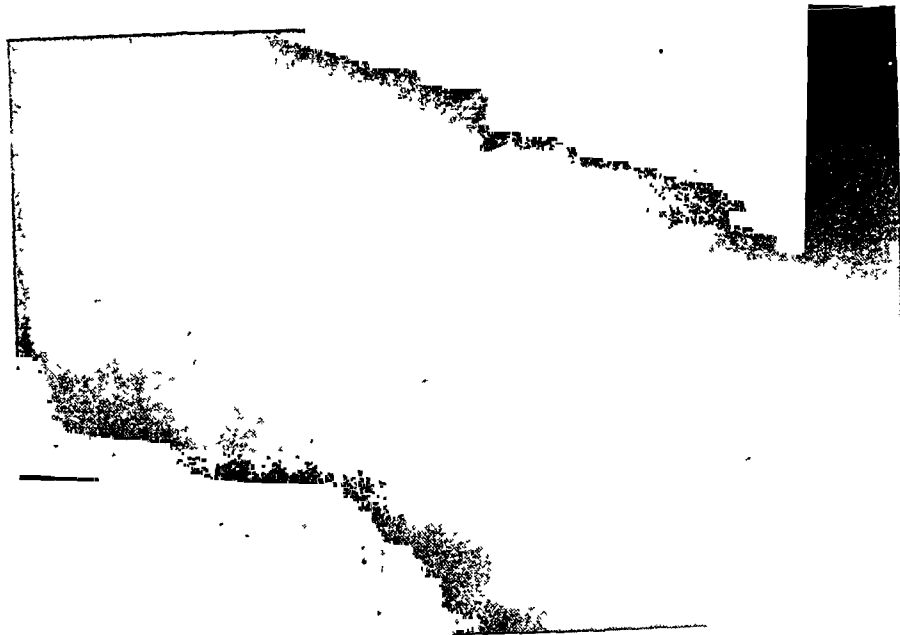


Fig. 12. Case 6. Planigram on readmission after the removal of the plaster of Paris-splint, showing the articular processes on the right side in place.



Fig. 13. Case 6. Planigram on read mission taken in the same sitting as the preceding one (fig.12) showing fracture-dislocation of the Vth — Vth cervical vertebra — that is of their left articular processes.

a fracture is seen here of the articular processes of the fifth cervical vertebra with a fragment which may very well have prevented the reduction, and explains the fresh dislocation. — The symptoms of the patient were negligible, only a moderate restriction of the turning and bending to the sides of the head. I let him go home, therefore, ($\frac{12}{100}$), asking him to resume work in order to find out how he fares. In a couple of days we shall then possibly contemplate open reduction.

The oldest method for the treatment of dislocations of the vertebral spine is probably the closed reduction. It has been applied and has been successful in some cases. It is easily imaginable that the prospects of success are greater the nearer to the head the seat of the dislocation. The farther down it is situated, already at the sixth and seventh cervical vertebrae, the prospects of affecting the dislocation by manipulation and turning of the head become considerably less, as there are then so many links between the point of attack, the head, and the dislocation, that traction as well as turning are split up and reduced, before they arrive at the seat of the dislocation. In order to reduce the dislocation the articular processes have to be disengaged, which is best effected by forward flexion of the head, which procedure actually has been proposed and carried out by some surgeons (f. i. WALTON, LANGWORTHY). A forward flexion of the head, however, greatly endangers the cord, which may be easily injured that way. Exacerbation has been reported of the neurological disturbances by such closed reduction (KUNDRAT, CAUSSE, a. o.), and several fatalities have been recorded associated with such manipulations. I suppose, therefore, that to-day we may look upon the closed reduction — in cases with involvement and lesion of the spinal cord — as a thing of the past.

The application of *the direct extension* on the head in cases of dislocation of the cervical spine has been first proposed and carried out, as far as I have been able to find out, by CRUTCHFIELD in 1933, and has been used to a considerable extent at several clinics in America, thus by GALLIE and MACKENZIE. In Norway the method has been used successfully by DOHLEN, who in 1942 in the Oslo Surgical Association reported 4 cases of dislocation in the cervical region treated with favourable results. DÖHLEN strongly advocated early reduction. Further, OTNES somewhat later has recorded one case of dislocation between the atlas and the epistropheus, also with good result. One only of DÖHLEN's four patients had neurological disturbances, viz. radicular symptoms.

It is perfectly clear, and needs no comments, that this direct extension is preferable to Glisson's sling. It is far more effective, and contrary to the sling it does not trouble the patient. It is difficult to imagine that it should be injurious. Certain objections may be raised against it, however, particularly in cases with neurological disturbances. More than ever it is important here that the reduction takes place as quickly as possible after the injury, preferably at once, and the sooner the more grave the disturbances. It is evident from the cases published, that it takes some time before the effect of the extension is apparent, some days — in cases where hours may prove of importance. We also know that the reduction does not always succeed by direct extension — my two cases demonstrated this.

I am of the opinion, therefore, that in cases with grave neurological disturbances, and most urgent in cases of transverse lesion, reduction should be performed without delay, and should be complete; this is the least we can do to save the cord or what is left of it. This cannot take place in any other way than by immediate open reduction under local anesthesia. One may then state: Three of the five patients operated on died. Yes, but the one — my first patient from 1932 — is fit for work today, and the three died, not due to the operation, but in spite of it. In two of these cases, in whom autopsy was performed, the cord was irreparably crushed, and the reduction in these three cases was of no use.

When SCHMIEDEN in 1930, and later also other authors, maintain that attempts at reduction should not be made in cases of transverse lesion, I consider this pessimism unjustified. My first patient constitutes a proof that these cases are not always hopeless, as does also WENZL's cases. It appears from a number of cases published, as stated by me in the Scandinavian text-book of surgery, edition 1934, that we are never able to establish a safe prognosis in the first few days after a spinal lesion with injury of the spinal cord. The X-ray examination gives no guidance, as the degree of the dislocation is not proportional to the extent of the injury to the spinal cord. Neither do the clinical symptoms during the first days after the injury permit any distinction between irreparable injuries to the spinal cord and the less serious ones. Firstly, we have to count with the fact, that there exist reversible commotions of the cord. Cases have been reported of gunshot wounds in the vertebral body with complete transverse lesion, without the vertebral canal or its contents having been

injured (WENZL). Also, we know that in cases of vertebral dislocation the mechanism of the transverse lesion includes, in addition to the direct pressure of the vertebra on the spinal cord and hyperextension of the cord, several other factors, namely: change in or suspension of the passage of the spinal fluid, direct pressure of extravasated blood, arterial anemia, and venous stasis — viz. secondary effects of the trauma, which do not follow instantaneously upon this, but in the course of the following hours and days, effects which may be very harmful to the nervous tissue, if they are not counteracted by an early reduction, but effects the clinical manifestations of which are frequently reversible. It is a well-known fact, that in patients with incomplete transverse lesion an exacerbation of the symptoms is observed during the following days, and on the other hand, if the patient survives, some improvement may occur later in the course, even if no reduction is performed. The cases of transverse lesion, which are improved or even cured by reduction, speak still more distinctly in that respect.

In my opinion, therefore, we are not permitted to remain passive in cases of transverse lesion by dislocations in the spinal column. They should all be submitted to reduction as soon as possible, for preference at once, in order that these reversible changes may be stopped and brought to regress. We are sure to treat then also some cases with complete crushing of the spinal cord, and the operation is of no use. By this active procedure, however, we may save some patients. When the pressure of the vertebra is relieved, the secondary results of the dislocation will be prevented or interrupted. The remains of the spinal cord which are anatomically intact immediately after the dislocation, may then be saved from secondary destruction.

Summary.

The author reports 6 cases of fracture-dislocation of the spinal column, 4 of them with complete transverse lesion; these 4 patients have been treated by immediate open reduction in local anesthesia. Three of them died. But the first patient (fracture-dislocation of the twelfth thoracic vertebra) was operated on 13 years ago; though he has yet some spasticity of the legs, he is now able to work and support his family as a chauffeur.

Another patient (fracture-dislocation in the cervical column)

was operated on (open reduction) 55 days after the accident. His pyramidal lesion and severe paresis is greatly reduced and he is actually (13 months after the accident): able to handle different tools, and writes well with his right hand, He has recently marched 12 kilometers in one day; his left hand and leg are in perfect shape.

The author is of opinion, that cases with fracture-dislocation of the spinal column and neurological symptoms including transverse lesion should be treated by immediate open reduction.

In some cases, where the spinal cord has been completely crushed — a situation, which cannot be diagnosed beforehand — the operation will prove useless. In other cases of transverse lesion the open reduction will save the remains of the spinal cord which are still anatomically intact from secondary, definite destruction.

Zusammenfassung.

Verfasser berichtet über 6 Fälle von Luxationsfraktur im Rückgrat von welchen 4 Verwundete die Symptome einer vollständigen Querschnittslähmung darboten; diese 4 Kranken wurden mit baldigster offener Reposition behandelt. Drei starben. Der erste aber — (Luxationsfraktur des XII. Brustwirbels) — ist vor 13 Jahren operiert worden und lebt wohl; mit einer gewissen Spasticität der Beine arbeitet er doch jetzt als Kraftwagenführer und kann seine Familie unterhalten.

Ein anderer Kranker — (Luxationsfraktur des V. Halswirbels) wurde 55 Tage nach dem Unfall reponiert. Seine Pyramidenbahnlähmung ist jetzt — 13 Monate nach der Operation — sehr gebessert: er schreibt sehr wohl und kann mit der rechten Hand verschiedene Instrumente benützen, Holz sägen und hacken, er hat 12 Kilometer an einem Tag marschiert.

Diese Fälle — Luxationsfrakturen mit neurologischen Ausfallsymptomen — eine Querschnittslähmung darin auch eingeschlossen — will der Verfasser mit baldigster offener Reposition behandeln. Fällen mit vollständiger Quetschung des Rückenmarks — was man gleich nach dem Unfall nicht diagnostizieren kann — werden durch den Eingriff nicht geholfen. In anderen Fällen aber wird die Reposition des Luxationsbruches die anatomisch noch gesunden Teile des Markes der sekundären, endgültigen Zerstörung entziehen.

Résumé.

Compte rendu de 6 cas de fracture-luxation de la colonne vertébrale, dont 4 avec le syndrome de paraplégie complète; ces 4 blessés étaient traités par une réduction immédiate à ciel ouvert sous l'anesthésie locale. Trois moururent mais le premier, opéré il y a 13 ans (fracture-luxation de la XII^e vertèbre dorsale) est actuellement — malgré une spasticité résiduelle des deux jambes — capable de gagner sa vie comme chauffeur d'automobile.

Un autre blessé (fracture-luxation de la V^e vertèbre cervicale), datant de 55 jours avant la réduction avait une grave hémiparésie avec spasticité (lésion du tractus pyramidal). Actuellement 13 mois après la réduction: Il travaille bien, il écrit bien (main droite); malgré une légère spasticité du genou droit, il a récemment marché 12 kilomètres dans la journée.

Pour ces blessés de la colonne vertébrale — fracture-luxation avec symptômes de lésion de la moelle — l'auteur préconise une réduction immédiate à ciel ouvert. Les cas de destruction complète de la moelle — un état de choses que l'on n'arrive jamais ni à vérifier ni à exclure d'avance — ne profiteront pas de cet intervention, qui est alors inutile. Mais dans quelques cas la réduction immédiate sauvera des restes encore intacts de la moelle — au point de vue anatomique — d'une destruction secondaire et définitive.

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Four Cases of Tuberculosis of the Kidney.

By

GUSTAF SÖDERLUND.

One gets the impression that, during the last few years, tuberculosis of the kidney has possibly diminished in frequency, just as other forms of so-called surgical tuberculosis, such as, for instance, tuberculosis of the bones and joints, and of the glands of the throat, have done in our country. It seems, too, as if renal tuberculosis, during the last few years, appears more frequently than before in more atypical forms. Last year, I had an opportunity of dealing with four cases of renal tuberculosis, all of which, in different respects, display interesting characteristic features distinguishing them from more typical forms of this disease. Both in their pathological-anatomical, diagnostical and operative-indicational aspects, the cases seem to be of interest sufficient to warrant a short account of them.

Case I. Alvar Valentin J. 42 years old. In November, 1928, he was struck in the right groin by a plank. About half a year after the injury, he felt aching in the groin and the right testicle began to swell. He was then admitted to the Maria Hospital in Stockholm and underwent operation there for tbc in the right epididymis.

On $11/9$ 1930 he was admitted to the Surgical Clinic of the Seraphimer Hospital on account of the swelling of the left epididymis. On cystoscopy, there was discovered a swelling around the left ureter orifice, while the right one was normal. No urine was obtained from the left kidney, while normal urine was got from the right one.

$1/10$: Epidymectomy. P. A. D. tbc. He was readmitted $3/12$ on account of urination distress.

$4/12$ Roentgen investigation: (LYSHOLM): The left renal pelvis was found altered into a large sac, with short, lumpy calyces. At the place of the left kidney there were found two calculus shadows as large as

a coffee-bean. The left ureter is distended to the width of one cm throughout the whole of its length. The right kidney-pelvis shows a normal picture, with calices minores sharply defined.

⁹/₁₂ Operation: Pyelolitotomy (SÖDERLUND). The left kidney was exposed in the usual way, posteriorly. The renal pelvis greatly enlarged but, at the moment, not distended. On palpation of the under pole of the kidney, there was felt a parenchymal bridge, about 4 cm wide and 1 cm thick, issuing from it medially, and continuing from it to the lower pole of the other kidney (horse-shoe kidney). After the renal pelvis and the ureter had been exposed, a calculus was felt wedged in, a couple of cm from the renal pelvis; a second stone lay in the renal pelvis. The wedged-in stone could be dislodged and pushed into the renal pelvis, after which, pyelotomy was performed and the stones extracted.

Subsequent course without remark. The patient was discharged ²²/₁, 1931. In 1935, he was attended for 10 days at the Maria Hospital, with the diagnosis: *Inflammation of the renal pelvis*.

In September, 1944, after a cold, he felt a severe general sense of sickness, with fatigue and evident emaciation and aching above the vesical tract and increased tenesmus, 5—6 times every night. Readmitted to the Surgical Clinic of the Seraphimer Hospital: ⁹/₁₀ 1944.

General condition good; temperature subfebrile, however, up to 38°, in addition to which he was troubled by an irritating dull pain in the umbilical tract, and in the right side of the back of the loins.

Urine: albumin +; the sediment 2 mm high, yellowish-white, compact, consist of white blood-corpuscles. No bacteria. No tubercle bacteria demonstrated. SR 54 Non-protein nitrogen = 40 mg %. Abdomen: soft and untender, no tenderness over kidney tract. To right of navel there is palpated a firm, non-displaceable tumor as large as a good sized orange; it is not displaced on breathing. The surface is smooth and the tumor is untender.

⁹/₁₀ Roentgen: urography; in the lower part of the right kidney there are a large number of irregular calcifications. Secretion begins in the usual time on the left side. On the right side no contrast secretion. The left kidney pelvis lies sagittally with a couple of the smaller calyces directed medially. Roentgen has discovered horse-shoe kidney. The kidney on the right side contains calcifications, and gives no secretion. On the left side, the kidney pelvis is distended.

¹⁰/₁₀ Cystoscopy (SÖDERLUND). Normal bladder capacity. Moderate edema at bottom of bladder, and great redness of the mucous membrane specially greatly pronounced at the right ureter orifice. Catheter could be inserted about 1 cm but no farther. At the sight of the left ureter orifice, similar alterations. The catheter could not be introduced here either. The alterations resemble those found in bladder-tuberculosis.

¹⁸/₁₀ Operation (SÖDERLUND). Extirpation of the right half of the horse-shoe kidney. An attempt was made to expose the right kidney extraperitoneally. It soon proved that section of the right rectus muscle by a transversal incision would be necessary in order to obtain a better survey; in addition, the abdominal cavity was

opened in order to gain better guidance. The right kidney was altered, showing a highly buffy appearance; the resistance, palpable exteriorly near the median line proved to be a sac, as large as a good sized hen's egg, containing thick pus; this was probably the kidney pelvis. By degrees the shrivelled kidney could be released from the very firm buffy coating of the connective tissue in the surrounding parts. It was difficult, above all, when loosening, to avoid injuring vena cava; the vessels had to be ligated one by one. The ureter, which was as thick as a small intestine, was of the same width all the way down to the little pelvis, and the greater part of it was removed after invagination. On palpation, the left kidney was felt to be normal, excepting that it had the form characteristic of a horse-shoe kidney. The alterations in the right kidney continued to about the middle of the bridge between the two kidneys which, at this place, was divided.

P. A. D. The kidney sent in consisted of 2 parts separated by a scarified area. Consequently, one can see a part with a relatively well preserved parenchyma, although with macroscopic foci of tbc. type, and another part which, macroscopically, displays the picture of a tuberculous pyonephrotic sac. Microscopic investigation confirms that we have present rich numbers of caseous tbc. suppurating foci and conglomerate tubercles.

Status $8/_{11}$. General condition very good. The back-ache gone. Before the operation the patient had to urinate 5—6 times a day, and twice in the night; now only 3 times in the 24 hours. No pains on urinating. The appetite very good after the operation; feels quite well. No subjective distress excepting a slight night-perspiration. Discharged $23/_{11}$. Control examination Sept. 1945. Feels quite well.

Epicrisis: the case, consequently, is that of a man of 40, in whom, in 1930, there was discovered hydronephrosis in the left kidney, with 2 concrements, one of which was wedged into the ureter and was assumed to have given rise to the hydronephrosis. The concrement was removed in the usual way, and it was then discovered that there existed a horse-shoe kidney with a rather broad and thick parenchymal bridge. Afterwards he was well until the close of 1944 when, at the hospital here, tbc was found in the right half of the horse-shoe kidney. By operation, carried out in consequence of severe buffy formations in the neighbourhood of a kidney pelvis filled with pus, there was removed the right half of the horse-shoe kidney.

Although, on the first operation the question was discussed if the kidney on the left side should be removed in toto, or not, it was thought, however — in accordance with the views which now prevail — that, in kidney operations, as conservative methods as possible should be employed in order to preserve the kidney. This determination was, of course, of great importance

as, 13 years later there was discovered a highly destructive tbc in the right half of the horse-shoe kidney.

Case 2. Ingrid Helene H. b. $11/9$ 1924, admitted to the Surgical Clinic of the Seraphimer Hospital $26/6$ — $21/7$ 1944, under the diagnosis, Tuberculosis renis sin.

In 1938, right-sided pleuritis and cutaneous tbc. on the left leg. In 1942 appendectomy, when tbc.-peritonitis was discovered. Ever since that time, diffuse abdominal distress, and aching above the urinary bladder together with very frequent tenesmus. Sometimes aching, too, in the loins and, now and then, fever up to 39° . February 1942 hematuria. On this occasion she went to St. Göran's Hospital where tbc. bacteria were discovered in the urine. She was then sent to another hospital in the town where urography was carried out. *Roentgen report:* "The secretion begins very slowly, but simultaneously on both sides. *Right kidney:* close to the lower calyces there are filled a couple of irregular cavities in the renal parenchyma. These cavities are indistinctly outlined; the lower calix is contracted. *Left kidney:* the lateral and lower calyces cannot be filled with contrast at their site; there are observed small, irregular collections of contrast, and, medially in the lower part of the kidney, a small collection of contrast almost as large as a hazelnut. The right ureter is of normal width. The left ureter is slightly distended, especially in the lower part of its course; its last part, for a length of a good 2 cm, fairly greatly contracted. The bladder is deformed and small. Within its left part, in the neighbourhood of the left ureter orifice, it shows a somewhat rigid contour.

The Roentgen investigation has shown signs of bilateral alterations within the kidneys, of the type one usually finds with tbc., together with alterations in the left ureter and the urinary bladder."

After the girl's father had spoken to me respecting her illness, she was admitted to the Surgical clinic of the Seraphimer Hospital, $26/6$ 1944.

Status: general condition good; was in good flesh; musculature good. Complains of smarting on urination and sometimes of fairly severe smarting over the vesical tract; fever now and then; nervous. SR 75. Temp. 37.5° , pulse 120.

$27/6$ urography: the same finds as on the previous examination.

Cystoscopy with ureter-catheterizing of right kidney; retrograde pyelography (SÖDERLUND). Normal bladder capacity, right ureter orifice without remark. Around left ureter orifice the vesical mucous membrane highly reddened and puffily thickened. The right ureter is catheterized. Urine from bladder: light yellow, albumin +, turbid, alkaline; sediment 7 mm high, compact, consist of white blood-corpuscles, fairly number of tbc.-bacilli.

Urine: from right ureter water-clear, neutral; no pathological sediment. Retrograde pyelography right side: kidney pelvis and upper calyces contrast-filled, without evident alterations. The irregular cavities which, on an earlier urography were filled with contrast, were now not filled with it.

³/₇ Operation. (SÖDERLUND).

Nephrectomia sin. The kidney moderately enlarged. In the lower pole a cavity as large as a walnut; the ureter distended, with highly thickened wall, the ureter stump invaginated. On section through the kidney there was found a cavity, as large as a walnut, in the lower pole, and caseous necrosis in all the papillaries up into the parenchyma. P. A. D. tbc.

²¹/₇ Subsequent course without remark; discharged with good general condition. Feels better now than for several years. Control examination: has later consulted me on different occasions: pus and tbc.-bacilli in the vesical urine still present, but general condition good and, subjectively, very inconsiderable distress.

Epicrisis: the case is one of a girl, 21 years old, who, on examination at a Stockholm hospital in 1942 was informed that she was suffering from bilateral kidney-tbc. This diagnosis had been made solely by urography and investigation of the vesical urine. Tbc.-bacteria and pus in the vesical urine were discovered and it was seen in the urogram that the left kidney was the seat of extensive tuberculous alterations, both in the kidney pelvis and in the ureter. The right kidney presented a normal kidney pelvis but below the lowermost calyx there was seen an irregularly shaped cavity, scarcely as large as a hazelnut, which, roentgenologically, was considered to be of tuberculous genesis. A fresh examination at the hospital here showed that the urine from the right kidney was without remark — ureter-catheterization not carried out before — but that the cavity visible on the urogram did not appear in the retrograde pyelogram. From this there was made the deduction that, even if the said cavity, too, was of tuberculous nature — a thing which was not certain, however still, it could be considered possible that the eventual tuberculous focus in the parenchyma could be healed. It was also considered that the right kidney, in other respects, was healthy and that no tbc. was present in the kidney pelvis nor in the ureter, and that, under such circumstances, there was indicated a removal of the highly tuberculous left kidney. This was all the more necessary as the patient's extensive vesical tbc was caused, first and foremost by the left kidney, on the removal of which her cure depended. The patient's severe distress was due, in the first place, to the vesical tuberculosis from which she suffered.

Case 3. Lilly Margareta M., b. ³/₇ 1899; admitted to the Surgical Clinic of the Seraphimer Hospital ³¹/₃—³/₆ 1944, under the diagnosis: *Tuberculosis renum amborum?*

Anamnesis: One childbirth, 1937. For the first time, in 1940, and, since then, 5 times, intense attacks of pain in the right kidney tract, which soon passed over.

At the new year of 1943, ever increasing tenesmus, with throbbing sensations in the urinary duct for a couple of weeks. The symptoms disappeared, but returned later on in the spring; the summer was free from distress but, in the autumn, there was renewed distress, with tenesmus up to 21 times daily. In February, 1944, she observed clotted blood in the urine, and the urine gradually became very sanguinous. She was sent to the hospital at Falkenberg where a roentgenogram of the urinary tracts was taken and cystoscopy was attempted. The doctor (*locum tenens*) at the hospital wrote to me on $30/3$ 1944 respecting the patient in question, stating that repeated sediment examinations showed a sterile pyuria and that the roentgen picture pointed a right-sided kidney tbc. without secretion; there existed hydronephrosis on the left side, with a distension of the pelvis as large as a goose egg. This was considered to point to a tbc.-stricture of the left uréter. Catheterizing of the ureter had been attempted three times unsuccessfully in consequence of the small capacity of the bladder (25—30 cc.). Non-protein had lain between 120—160 but the general condition was relatively very good and the patient's distress severe. It was thought that Coffey should be considered and application was made to have the patient transferred to the Surgical Clinic of the Seraphimer Hospital to which she was admitted $31/3$ 1944.

Status: General condition rather good, has stayed up. SR 52, non-protein 71, afebrile. She complains of the constant and painful tenesmus. Abdomen: without remark, per rectum 0. Urine: yellowish grey, very turbid. Sediment: 20 mm high, consisting of white blood-corpuscles, a few coli bacteria, tbc. +.

The roentgen plate taken in Falkenberg (examined by LYSHOLM), urography: no secretion on right side. On the left side there is gradually being filled a hydronephrosis as large as a goose egg, continuing obliquely down to the bladder in a highly distended ureter. The bladder shrivelled, capacity 30—50 cc.

By stretching the bladder twice daily its capacity was gradually increased to 100 cc. Non-protein fell by degrees, and more rapidly after a Pezzer catheter had been inserted, down to 60, 48, 46 and, finally, to 36 mg % ($25/4$). Simultaneously, the patient grew calmer and felt better. $26/4$ operation (SÖDERLUND).

Nephrectomia dx: the kidney moderately enlarged, fixed lightly to its surrounding, the surface coarsely bossy; the ureter moderately thickened. Section through the organ displayed a large number of caseous caverns as large as a walnut.

P. A. D. Extensive tuberculosis with caverns, and with ulcerations in the calyces.

Subsequent course good. After some days the Pezzer catheter was removed and the patient retained the urine without tenesmus for three hours; the bladder capacity still no more than 100 cc. General condition much improved, subjectively, inconsiderable distress; patient feels stronger. Non-protein 33 mg %.

Epicrisis: the case is that of a married woman of 45 who, for the last $1\frac{1}{2}$ year has had vesical distress and who, when examined at the hospital of her town in February—March 1944 was found to have pus in the vesical urine with tbc. +; the urogram showed no secretion from right kidney, but a greatly distended renal pelvis and ureter of the left; shrivelled bladder containing 25—30 cc and non-protein varying between 70—120—160 mg %, simultaneously, the general condition was good. It had been considered that her right kidney was affected with tbc., and that the hydronephrosis on the left side was caused by a tuberculous ureter-stricture.

However, after catheter treatment here twice daily and, above all, after treatment with an indwelling Pezzer catheter, the non-protein fell to 36 mg %, it was considered that the hope which had been entertained that the hydronephrosis on the left side had not been caused by a stricture, but was due to resistance from the shrinkled bladder, was verified, and the right kidney which was the seat of an extensive cavernous phthisis was removed. After this the patient's general condition improved rapidly, the bladder-capacity could be increased to 100 cc, and the patient could retain her urine for as much as 3 hours.

Case 4. Ragnhild Aurora N., b. $18\frac{7}{7}$ 1908, admitted to the Surgical Clinic of the Seraphimer Hospital $29\frac{2}{2}$ — $22\frac{3}{3}$ 1944 under the diagnosis: Tuberculosis renis sin. + Anaemia secundaria, $7\frac{4}{4}$ — $9\frac{4}{4}$ 1944 under the diagnosis: Abscessus periureter. sin. tuberculos., $22\frac{8}{8}$ — $29\frac{8}{8}$ the same year under the diagnosis: Fistula tbc. post ureterectomiam.

Healthy up to 1934 when she began to be troubled by attacks of fever, with shivering and fever-maximums up to 40° . Thus, during the period 1934—1941 she had every year one or more such fever-periods but *without other* symptoms; the attacks were sometimes of short duration, and sometimes lasted as much as 2 months. After she had consulted a large number of doctors without result, and had had been prescribed different medicines, she was admitted in 1941, after visiting the Medical Policlinic of the Seraphimer Hospital, to the Medical Clinic there. Here, *inter alia*, there was carried out a roentgen examination of the gall- and urinary passages but without pathological finds. The report of the examination of the urinary tract said: "With urography, simultaneous secretion beginning at the normal time, with filling up of the normally shaped kidney pelvis and ureters. No concrement, no stasis." Widal, Weil and blood culture negative. Abortion in mens VI 1939. Since 1941 suppurating, bloody discharges from the abdomen which continued even after she had been operated at the beginning of 1942 at the General Maternity Hospital (Prof. Olow) for degeneratio cystica ovarii dxt. In July, 1942, when she was at the

Maternity Hospital, there was opened and drained an abscess in spatium urethro-vaginalis; in October 1942 she was once more admitted to the Maternity Hospital when she underwent débridement of a fistula after the abscess. On examination by Prof. OLOW, $17/3$ 1943, she was free from distress. On $8/3$ 1943 she had a severe hematuria which lasted three days. In connection with this she felt severe pains in the left side of the abdomen, radiating downwards; the fever rose to 39.4° on the $21/3$ when she was again admitted to the General Maternity Hospital. *Inter alia*, she was examined by cystoscopy (OLOW) respecting which it was noted that the *vesical mucous membrane was without remark*. Patient discharged $27/3$. In the early summer, 1943, severe ache in the back on the left side down-wards to the groin. On $26/7$, renewed blood-mingled flux and, simultaneously, tenesmus. Readmitted to the Maternity Hospital on the $28/7$.

From her *Status* there is noted that no resistance could be palpated in the abdomen and that there was no tenderness over the kidney tract. S R 100.

$31/7$ Cystoscopy (OLOW): normal vesical capacity, ureter orifices without remark; the ureter catheter can easily be inserted on both sides, urine in normal drop-tempo. The urine contains a few coli bacteria, otherwise without remark. — Patient afterwards admitted to the General Maternity Hospital for the next following months, during the whole time having now and then attacks of dull, grinding pain in the left kidney tract; suppurating discharge from vagina without its being possible to discover its source. On $31/1$ 1944 there was carried out débridement of the old paraurethral fistula passage, which led up towards the left perimetrium. S R 137—145. As she again had high fever on the $28/1$ 1944 she was remitted to the Medical Clinic of the Seraphimer Hospital. From her *Status* on admission here, there may be quoted: Thin, poor musculature, not specially pale. Abdomen: on bimanual palpation over the left kidney tract there is gained an impression of an resistance which can be made to move backwards and forwards between the hands. S R 137. Red blood-corpuscles 3.3 mg. Non protein 33 mg %. Urine sediment: growth of coli. Roentgen of kidney on $26/2$: at the place for the left upper kidney pole there is found an increased soft tissue density the boundaries laterally of which cannot be determined reliably; this alteration continues, without any sharp boundaries into the ureter; the secretion considerably delayed. After about 2 hours, a distended kidney pelvis, with distended calyces, is filled. "In 1941", writes LYSHOLM finally, "the renal pelvis was not distended, and the ureter was normal, but the upper part of the kidney pelvis was displaced laterally downwards, while the upper kidney-pole appeared to be swollen into a lump. The process, consequently, existed even then, but has since increased in size."

In consequence with this roentgen report, the patient was transferred, $29/2$, to the Surgical clinic, where, on palpation of the left kidney tract, here could clearly be felt a fairly large resistance.

$6/3$ Cystoscopy, with ureter catheterization (SÖDERLUND). The vesical mucous membrane slightly reddened, but otherwise normal, as was, too, the ureter orifice.

Right: Urine fairly clear, acid. albumin+, $\frac{1}{2}$ -mm gravy-like sediment, fairly rich number of red blood-corpuscles and some few white ones. 0 bacteria.

Left: Urine fairly clear, alkaline. Scarcely discernible sediment, 4—6 white blood-corpuscles, 3—5 red ones; a few coli-like rods.

$\frac{8}{3}$ Operation: (SÖDERLUND).

Nephrectomia sin.: usual lumbar section, with resection of C XII: the kidney was felt to be about 3 times as large as a normal one; very firmly attached to its surroundings, especially medially. The upper pole as large as a good-sized fist with thick rind grown firmly around it. Towards the renal hilus tract a very extensive rind-formation, about 4 fingers thick, attaching the kidney to v. cava, and continuing downwards along the ureter. The process gave the impression of being of inflammatory nature. The hilus vessels bedded in the rind were ligated separately. The ureter is transformed into a solid formation, as thick as a small intestine, with thick walls and a narrow lumen. The kidney could be removed in its entirety, and the greater part of the ureter, too, was taken, although not quite down to the bladder. On section through the kidney, the upper pole was found to be occupied by an abscess as large as a mandarin-orange with repulsively stinking pus; it was not in connection with the pelvis which appeared to be normal.

P. A. D. In the upper pole of the kidney, a large cavernous formation, the wall of which shows caseous and productive tbc.

The patient discharged cured, $\frac{22}{3}$, subjectively and objectively well. Readmitted $\frac{7}{4}$ with pains in the lower part of the scar; diarrhea and fever. — $\frac{24}{4}$ Operation (SÖDERLUND).

Ureterectomy: Around the upper ureter end, an abscess, as large as a hen's egg, with malodorous pus, which was emptied and drained. The ureter removed down to the bladder. Discharged $\frac{9}{5}$ healed. Readmitted $\frac{22}{8}$ 1944 for a little fistula in the last scar. The fistula scraped out.

P. A. D.: tuberculous granulation tissue. Patient discharged the following day to Outdoor-Patients' Department. Afterwards well.

Epicrisis: The case was a married woman, 36 years old, who, during the last 10 years, had, yearly, frequent attacks of fever. During the first 5 years, nothing but fever symptoms, during the last years, in addition, hematuria and attacks of pain in the left flank, fistula formation in spatium urethro-vesicale, etc.

On urography, 1941, there was observed a normal renal pelvis on the left side which, however, even then, was displaced downwards and laterally. On repeated examinations at the gynecological department during 1941—1943 with, *inter alia*, cystoscopy on several occasions, nothing pathological from the urinary tracts could be observed; urine without remark.

In January 1944, there was palpated at the Medical Clinic of the Seraphimer Hospital to which the patient had been sent, a

filling in the left renal tract, and when a fresh roentgen examination was now made, there was discovered an expansive process in the left upper renal pole. On operation at the Surgical Clinic of the Seraphimer Hospital, there was removed a greatly enlarged kidney surrounded by solid rind. There was also removed the greater part of the ureter, which was as thick as a small intestine, had a thick wall and a narrow lumen. In its upper pole, the kidney contained an abscess as large as a mandarin-orange containing repulsively stinking pus. P. A. D. Tuberculous cavern, with coli infection. The renal pelvis without remark.

Pathologic-anatomically and pathogenetically, the case should be thus described: From a tuberculous primary affection in the upper pole, there had been developed a cavern which afterwards became coli infected, *i. e.* a closed kidney tbc. with mixed infection and *without connection with the renal pelvis*. A very uncommon morbid picture.

Summary.

The author relates four cases of tuberculosis in the kidneys that with regard to clinic, especially diagnosis, the indication of operation and the pathological anatomy might be considered to be of so great an interest that the publication of the four cases is justified.

Case 1. Man, 42 years old, was operated 1930 at the Seraphimer-hospital for a rather big hydronephrosis in the left side of a horse-shoe kidney; pyelolithotomy; 1944 an extensive tuberculosis in the right half, which was removed at the same hospital; discharged cured.

Case 2. A girl, 20 years old; 1942 tuberculous bacilli and pus in the urine. On urography extensive tuberculosis alterations in the *left* kidney; in the right kidney a few irregular cavities, which were also considered to be of tuberculous nature. She was sent home. On renewed examination 1944 at the Seraphimerhospital it was found, that the urine from the right kidney was without remark and that the cavities in the same kidney were not visible on retrograde pyelography. The tuberculous left kidney was removed; discharged cured.

Case 3. A married woman, 45 years old, had the last 3 years cystitis, in the urine tuberculous bacilli and pus. At urography extensive tuberculosis in the right kidney and a rather large hydronephrosis in the left kidney; non-protein-nitrogen about 100 mg %; the urinary bladder very small (shrivelled). After treatment at the Serafimerhospital with Pezzier-catheter (à demeure) the non-protein-nitrogen diminished to 36 mg %; the highly tuberculous altered right kidney then was removed, and the bladder was gradually distended; discharged in good condition, bladder capacity 100 cc.

Case 4. A married woman, 35 years old, had the last 10 years had periodic attacks of fever, up to 40 d. C. without local symptoms. By urography in 1941 nothing reliably abnormal in the urinary tract; urine normal. By new urography at the Serafimerhospital 1944 was found an exclusive congestion of the upper pole of the left kidney and a displacement of the kidney downwards and laterally. *Nephrectomy* was performed; in the upper half a large cavern with coli-pus; no communication with the pelvis. Histological investigation: tuberculosis; discharged cured.

Zusammenfassung.

Verf. teilt vier Fälle von Nierentuberkulose mit, die in bezug auf ihre Klinik, besonders ihre Diagnose, ihre Operationsindikation und ihre pathologische Anatomie so interessant zu sein scheinen, dass eine Veröffentlichung angezeigt sein dürfte.

Fall 1. 41jähriger Mann, im Jahre 1930 im Serafimerkrankenhause wegen einer ziemlich grossen Hydronephrose in der linken Hälfte einer Hufeisenniere operiert; Pyelolithotomie. Im Jahre 1944 wurde in der rechten Hälfte eine ausgedehnte Tuberkulose gefunden und diese Hälfte im gleichen Krankenhause entfernt. Gesund entlassen.

Fall 2. 20jähriges Mädchen. Im Jahre 1942 Eiter und Tuberkelbazillen im Harn. Bei der Urographie ausgedehnte tuberkulöse Veränderungen in der linken Niere; in der rechten Niere einige unregelmässige Höhlen, die gleichfalls als tuberkulöser Natur aufgefasst wurden. Sie wurde nach Hause geschickt. Bei erneuter Untersuchung 1944 im Serafimerkrankenhause wurde festgestellt,

dass der Harn aus der rechten Niere o. B. war, und dass die Höhlen in dieser Niere bei retrograder Pyelographie nicht hervortraten. Die tuberkulöse linke Niere wurde entfernt. Geheilt entlassen.

Fall 3. 45jährige Frau. Hatte in den letzten drei Jahren an Zystitisbeschwerden gelitten; im Harn Eiter und Tuberkelbazillen. Bei Urographie ausgedehnte Tuberkulose der rechten Niere und eine ziemlich grosse Hydronephrose der linken; Reststickstoff etwa 100 mg%; Harnblase klein und geschrumpft. Nach Behandlung im Serafimerkrankenhause mit Pezzer-Katheter (Dauerkatheter) sank der Reststickstoff auf 36 mg%. Darauf wurde die tuberkulös stark veränderte rechte Niere entfernt, und die Blase wurde allmählich gedehnt. Die Kranke wurde in gutem Allgemeinzustande und mit einer Blasenkapazität von 100 ccm entlassen.

Fall 4. 45jährige Ehefrau, hatte in den letzten zehn Jahren periodische Fieberattacken von bis zu 40° ohne lokale Symptome gehabt. Bei Urographie im Jahre 1941 wurde in den Harnwegen nichts deutlich Anormales festgestellt; Harn o. B. Bei erneuter Urographie im Serafimerkrankenhause im Jahre 1944 fand man bedeutende Schwellung des oberen Pols der linken Niere sowie Verlagerung der Niere nach unten-lateral. Nephrektomie. In der oberen Hälfte der linken Niere eine grosse Höhle mit koliartigem Eiter, ohne Verbindung mit dem Nierenbecken. Histologische Untersuchung: Tuberkulose. Geheilt entlassen.

Résumé.

L'auteur rapporte quatre cas de tuberculose rénale qui semblent présenter tant d'intérêt au point de vue de la clinique — surtout en ce qui concerne le diagnostic — de l'indication opératoire et de l'anatomie pathologique, que leur publication peut être considérée comme justifiée.

Cas 1. Homme de 42 ans. En 1930 il avait été opéré à l'Hôpital des Séraphins d'une assez grande hydronéphrose de la moitié gauche d'un rein en fer à cheval; pyélolithotomie. En 1944 on constata l'existence d'une tuberculose extensive dans la moitié droite du rein, qui fut enlevée dans le même hôpital. Sortit guéri.

Cas 2. Jeune fille de 20 ans. En 1942, pus et bacilles de Koch dans les urines. A l'urographie, lésions tuberculeuses étendues du rein gauche; à droite, quelques cavités irrégulières, qui furent également considérées comme étant de nature tuberculeuse. Elle fut renvoyée chez elle. Lors d'un nouvel examen en 1944 à l'Hôpital des Séraphins on constata que l'urine du rein droit ne présentait aucune particularité, et que les cavités, de ce côté, n'apparaissaient plus à la pyélographie ascendante. Le rein gauche tuberculeux fut enlevé; sortit guérie.

Cas 3. Femme de 45 ans. Avait souffert de cystite pendant les trois dernières années; pus et bacilles de Koch dans les urines. A l'urographie on voit une tuberculose extensive du rein droit, et à gauche une hydronéphrose assez considérable; azote résiduel d'environ 100 mg%; vessie petite, rétractée. A la suite d'un traitement par sonde de Pezzer (à demeure) à l'Hôpital des Séraphins l'azote résiduel tomba à 36 mg%. Le rein droit fortement atteint de tuberculose fut ensuite extirpé, et la vessie se dilata progressivement. La malade quitta l'hôpital en bon état général et avec une capacité vésicale de 100 cm³.

Cas 4. Femme mariée de 45 ans. Au cours des dernières dix années elle avait souffert d'accès fébriles périodiques jusqu'à 40° sans symptômes localisés. L'urographie en 1941 ne montra aucune anomalie manifeste au niveau des voies urinaires; rien de particulier dans les urines. Lors d'une nouvelle urographie à l'Hôpital des Séraphins en 1944 on découvrit une tuméfaction considérable du pôle supérieur du rein gauche, accompagnée d'un refoulement de l'organe en bas et en dehors. Néphrectomie. Il existait dans la moitié supérieure du rein gauche une grande caverne avec du pus semblable à celui dû aux colibacilles, mais sans communication avec le bassin. Examen histologique: tuberculose. Sortit guérie.

From the Surgical Department of Crown Princess Lovisa's
Children's Hospital, Stockholm.
(Head at the time: JAMES HINDMARSH †.)

Accidents in Childhood.

By

JAMES HINDMARSH †, GUNNEL MELIN and KARL-AXEL MELIN

Preface.

On the initiative of the late Doctor JAMES HINDMARSH, head of the Surgical Department of Crown Princess Lovisa's Children's Hospital, an examination was commenced in the year 1940 of the accident material of this department during the 10-year-period of 1930—1939. When, at the end of 1941, the preliminary results were presented to HINDMARSH, the material was found to have a wider general applicability than expected. Furthermore, by the kind courtesy of Doctor ÅKE NETTELBLAD, head of the Dalsland Hospital at Bäckefors, the childhood accident material of that hospital, during an approximately corresponding period of time, was placed at our disposal. In this way, an excellent opportunity was obtained for a comparison between town and country conditions.

On the basis of the fore-mentioned investigations, steps were taken during the past few years by our department to institute an extensive propaganda regarding accidents to children. Owing to the widening of the scope of the inquiries, and further, to the regrettable death of Doctor HINDMARSH, it has not been possible until now to publish the final results. The Board of the Insurance Company Gothia has shown great interest in this work and kindly contributed to the costs of this publication.

Gunnel Melin.

Karl-Axel Melin.

Introduction.

The accident injuries in childhood differ in many respects from those occurring at a later age. Certain conditions connected with the young individual's surroundings and physical as well as mental properties render some types of accidents predominant and, at the same time, characterize the type of injury. It will suffice merely to point out the great frequency of burns and facial as well as cranial injuries, as compared to the comparatively rare occurrence of such accidents as dislocations, meniscal lesions, ankle and spinal fractures. In fact, certain accidents, *e. g.*, subluxatio radii, are only to be met with in childhood. Moreover, the course of the injuries is different from that of adults. Thus, the prerequisites of healing seem to be distinctly more favourable in children and accident injuries causing permanent damage are actually extremely rare in childhood.

Under these circumstances, it has seemed worth while to attempt a compilation of observations of accident injuries during childhood from a more extensive material, with particular regard to their mode of origin and nature. An investigation of this kind, based on a numerical calculation of a more comprehensive material, has not to our knowledge been published earlier. However, EDBERG gave a brief exposé in the year 1939 on these questions, with main stress on the prophylactic side of the problem of childhood accidents.

The present material comprises in all 5,083 children subjected to accident injuries, and has been collected during the ten-year-period of 1930—1939. It has, accordingly, been concluded before the problems relating to the war period could exert any influence in this matter. The total number of cases at disposal have been included, with the exception of those occurring at parturition, which have not been considered as applicable to the particular injuries dealt with in this paper.

The cases have either been treated at the Surgical Department of the Crown Princess Lovisa's Children's Hospital (C. L. H.) or at the Dalsland Hospital (D. H.), Bäckefors. The clientele at C. L. H. derives practically only from the town population while the Bäckefors material, which has been included for the sake of comparison, represents exclusively cases from the rural districts. Table 1 illustrates the number of cases at the C. L. H., and the extent to which the severity of the injury has required admission to the hospital.

A comparison between the total admission to C. L. H.'s surgical

Table 1.

	C. L. H.
Patients admitted to the hospital . . .	1,833
Policl. treated patients	2,924
Sum	4,757

department and the accident cases admitted there indicates that the accident injuries take up a great number of the places reserved for treatment at the department. During the period concerned, the total number of patients equalled 13,015. Thus, the 1,833 admitted accident injuries constituted approximately 14 per cent. of the total capacity. A closer analysis of the distribution per annum (Table 2) will show that the number of admitted accident injuries has been subjected to a continuous increase.

Table 2.

Childhood accidents during the years 1930—1939.

(Data compiled from the annual reports of the two hospitals.)

Year	C. L. H.						D. H.		
	Adm. to dep.			Policl. treatm.			M.	Fem.	Total
	M.	Fem.	Total	M.	Fem.	Total			
1930	45	16	61	26	16	42	0	1	1
1931	57	18	75	40	34	74	30	7	37
1932	50	49	99	60	47	107	19	9	28
1933	119	84	203	114	96	210	18	4	22
1934	104	56	160	140	101	241	12	8	20
1935	146	69	215	148	129	277	15	9	24
1936	99	52	151	168	139	307	19	15	34
1937	161	79	240	273	193	460	25	21	46
1938	201	105	306	302	211	513	33	14	47
1939	220	103	323	386	301	687	42	25	67

This is due to a number of different factors, the most important ones being, no doubt, partly the change brought about in the use of the department in 1933 to that of holding acute cases, and partly the fact that the Police and the Ambulance Service have, in general, begun to turn increasingly to the C. L. H. in the event of accidents and not, as previously, to the various surgical clinics for adults in the city. In addition, it cannot be denied that a slight relative increase has been noticed, which is evident, *inter alia*, from the proportionately greater number of beds at the C. L. H. occupied by accident cases (Table 3). However, this has probably been of minor significance in this connection.

In the out-patients' department, a similar, although even more accentuated increase of accidents has been noted. In 1930, only 42 patients of this type were admitted there, compared to 687 in 1939.

Table 3.

The number of accident cases admitted to the surgical department of the C. L. H., calculated in percentages of the total number of admitted patients.

Year	1930	31	32	33	34	35	36	37	38	39
%	4.8	5.5	9.2	16.2	14.9	18.2	11.2	16.3	19.3	21.4

Boys form the majority among the injured cases. The number of girls is invariably lower, at times being only half or a third of that of the boys (Table 2). It is interesting to see that the predominance among male accident injuries, which occur for natural reasons at a grown-up age, is conspicuous as early as during the first years of life. Apparently, certain typically masculine characteristics manifest themselves at a very early stage and serve directly to give rise to accidents. TUGENDREICH (1927) and PIRQUET (1929) both lay stress on these conditions, stating that the relationship between the frequency of accidents among boys and girls, respectively, is approximately 3 : 1. Also RIETZ (1930) arrives at similar results regarding the mortality cases in a Swedish city material. He has submitted the death causes to a closer analysis. He ascertained, in this particular instance, that the surplus mortality of boys was most marked in cases where the typically masculine trait had been manifested. Thus, drowning was 7 times more frequent, and traffic accidents 4 times more so, as compared to girls.

The age distribution in this material (Fig. 1) discloses a marked accident frequency during the first three years of life. This is not, as might be supposed, attributable to the fact that treatment is more often sought in the case of younger children. A corresponding high frequency is found also in patients admitted to the hospital, *i. e.* the most severe injuries. TUGENDREICH points out, concerning the death causes, that the infant age (1—2½ years) is most exposed to these injuries. Also RIETZ draws attention to the particularly great frequency of accident cases in the second and third years of life. The reduction in the number of accidents after the age of 10 is, no doubt, to be explained by the delimitation of the material owing to the great number of children in these ages in Stockholm which have been subjected to treatment also at other surgical departments. A comparison with the Bäckefors material, which has only one hospital available, proves the accuracy of this assumption. Here the curve runs fairly horizontally through the first teens.

When the accident cases in the material are distributed over the several months of the year (Fig. 2), the majority will be seen to have taken place during the warmer seasons. It is noteworthy

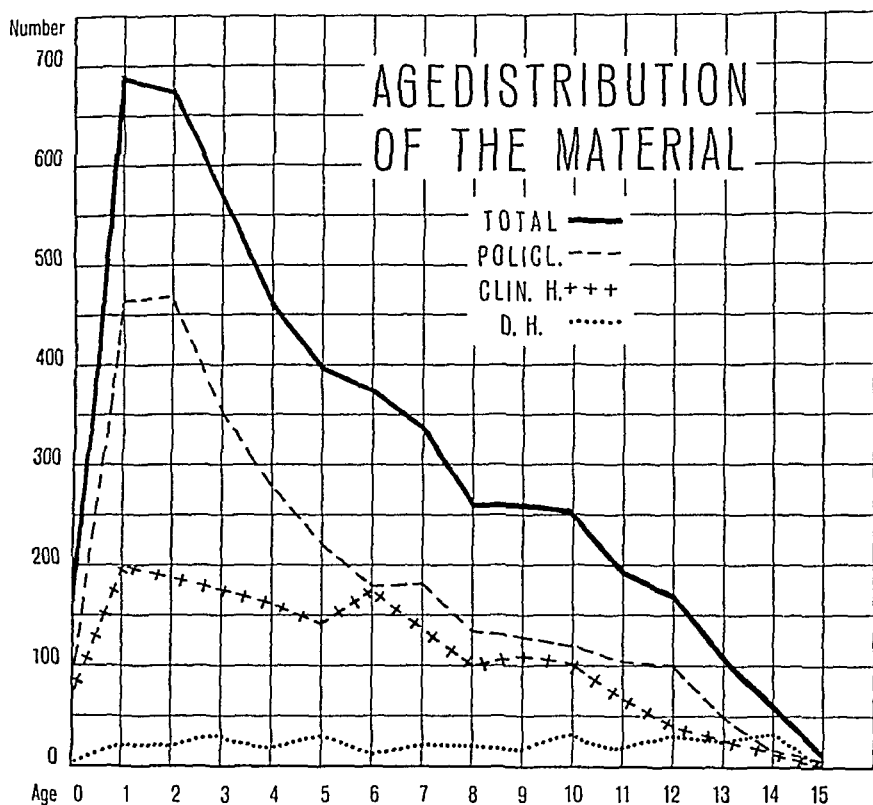


Fig. 1.

that the clinical and polyclinical material of C. L. H., as well as the Bäckefors material show a maximum frequency of accidents during the later part of the summer and the autumn. The decrease in frequency during the height of summer in the Stockholm material is accounted for by the absence of a fairly great number of children from the city at that time. The Bäckefors curve at this time describes an even rise and is, without doubt, more correct in this respect. It is difficult to determine the reason for the increase in accidents during the first school months. It may, conceivably, be favoured by the deteriorated light and weather conditions. It is also possible, in the case of the Stockholm children, that the freer life lead during the summer has rendered them less accustomed to the more precarious existence in a city.

The distinctly favourable results after accidents in childhood were pointed out in the introduction to this paper. Only 22 out of 5,000 children have died, approximately 2,000 of whom had been subjected to severe injuries. However, the reason for this relatively low mortality rate is, inter alia, to be found in the fairly great number of children who have died in direct connection with the accident and have never been brought to the hos-

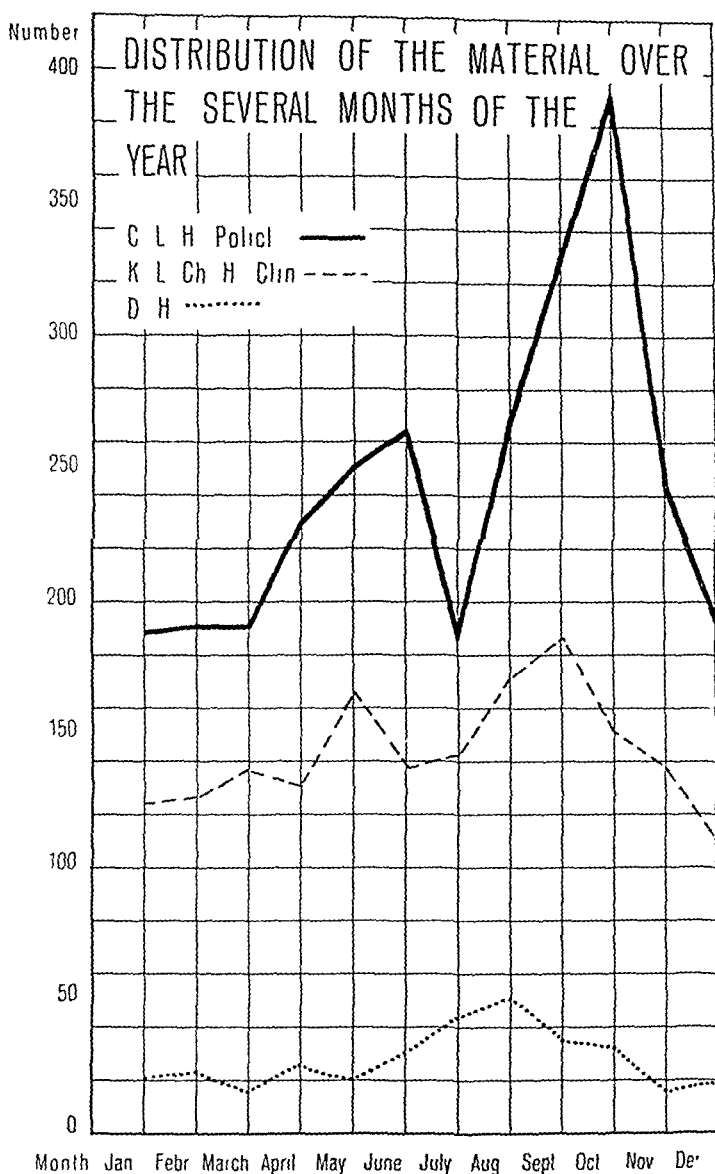


Fig. 2

pital. The children who manage to overcome the first shock have a distinctly greater capacity of survival and recovery than adults. This is evident from the low mortality rate in the material.

15 of these 22 deaths are due to burns, 5 to injuries of cerebrum and abdominal organs, and only 1 to a fracture. The one death owing to an infected accident injury confirms the general conception of the rare occurrence of complications to childhood injuries by severer infections.

However, the above-mentioned figures must not be allowed to detract from the significance of the children's accidents in the mortality statistics. As already pointed out, a number of cases never come to the hospital. A perusal of the official statistics will

show that in our country approximately 350 children die every year on account of accident injuries. About a third of these cases are subjected to a drowning death which is a death cause of great significance and entirely lacking in the material published here, since there is never time to bring these children to a hospital. RIETZ also stresses the great significance of accident injuries with regard to childhood mortality. He finds that 7—10 per cent of children's deaths in each year of life, from and including 1 year of age, can be attributed to drowning.

Causes of Injuries.

The accident injuries vary to a great extent within the different age-groups. The same type of accident may be met with at all ages, but a pronounced accumulation of cases in a certain period is often noted. During early infancy, the child is quite helpless and entirely dependent on the care of the nurse. Lack of attention or want of judgement on the part of those in charge usually explain accidents in this age group. As soon as the child has begun to join actively in the life of its surroundings, to move and to grasp at things, etc., the prerequisites of accidents are considerably enlarged. Moreover, the attention and care of those in charge of the child still play the most important part and continue to do so during the whole of childhood. The child is not to be blamed should it, when left alone, crawl out through an open window or step straight out into the traffic when playing out of doors. Nevertheless, the more the child adds to its field of activity, which happens with increase of age, the more does it contribute itself towards the number of accident risks.

During early infancy, which comprises the time up to and including the first year of life, and particularly during the time of the child's first entry in life, the accidents occur in the majority of cases without the cooperation of the child. In connection with the treatment of the infant, a number of serious accidents are liable to happen. The child is often placed on weighing-machines and nursing-tables in a high position and is left alone there. The child may then, by a shake of the table or by its own movement, fall to the floor. This has occurred 14 times in the present material. There is another danger, viz., that the child is dropped when moved from one place to another. This has taken place in 6 cases. 15 of these 20 children have been subjected to cranial injuries, most of them of a serious kind, 10 having obtained fractures on one of the cranial bones. The great majority of head injuries may be attributed to the comparative heaviness of the head at this

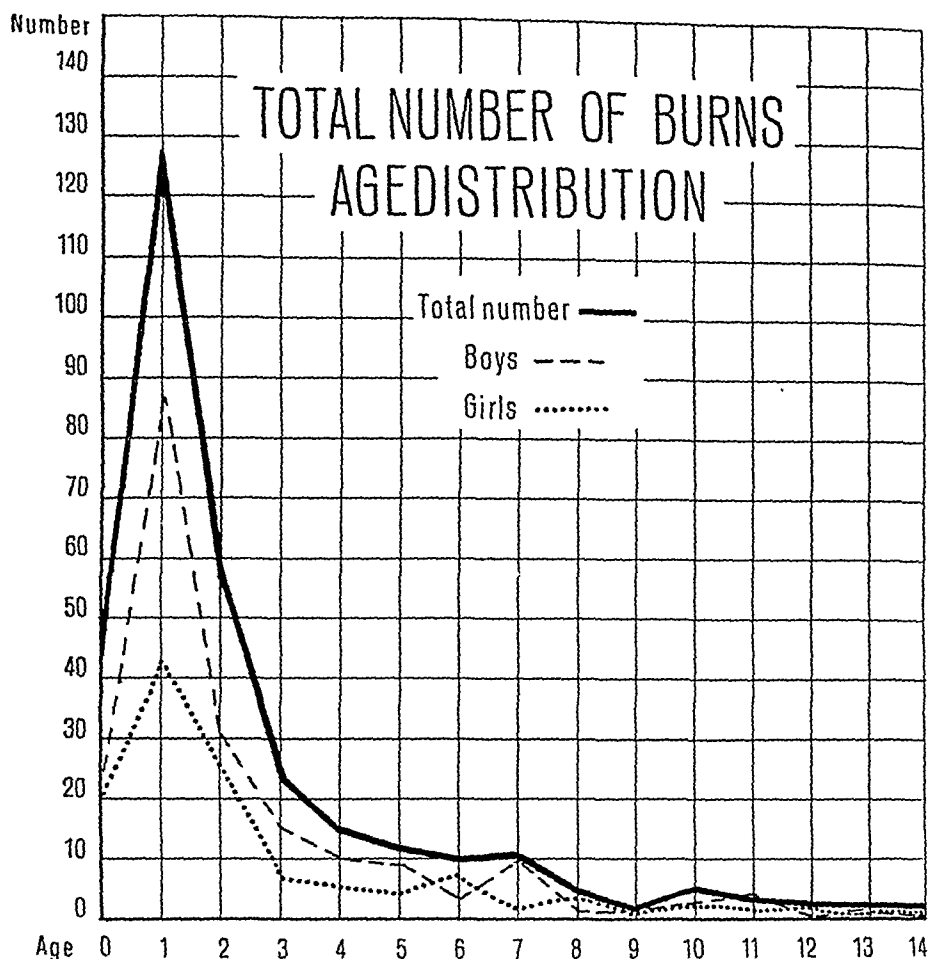


Fig. 3.

age. The remaining 5 children sustained fractures of one of the bones of the lower extremities.

At infancy, and to a still greater extent, at the age of playing (*i. e.* 2 years and up to and including 5 years), the burns predominate. According to RIETZ, this forms one of the most common death causes in the age group 1—5 years, 68 of the 91 deaths due to burns in his material, *i. e.* 75 per cent, belonged to this age group. The sensitivity to heat is particularly developed in the lower ages and the possibilities of accidents are therefore very numerous practically everywhere. In the present material, 315 cases have been observed, *i. e.* 6.2 per cent of the total number. The age distribution, which is illustrated in Fig. 3, clearly indicates the marked accumulation within the 1-year age group, in particular.

An analysis of the immediate cause of these burns, as shown in Fig. 4, discloses the fact that the great majority of these accidents are due to scalding with hot water, coffee, gruel, or other similar fluids. 236 of the 315 cases, *i. e.* 74.9 per cent, happened in this

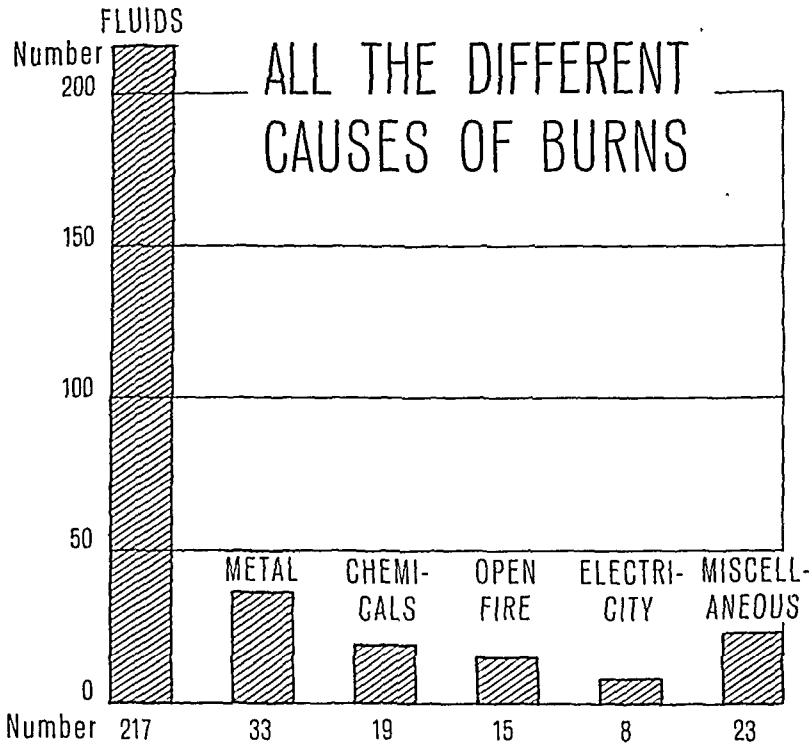


Fig. 4.

way. The child is often allowed to sit on the arm or in the lap of the grown-up while he is eating. It may then either upset a cup of coffee or a plateful of gruel over itself, or the grown-up may spill some of the hot fluid on to the child for some reason or other. At other times, the child may upset a saucepan full of hot fluid on the stove over itself, or may turn over or fall into a tub or pail of hot wash solution on the floor. If the hot fluid should contain some kind of chemical, *e. g.* a strong detergent, the accident becomes more complicated, a chemical effect having been added to the scalding. This has been noted in 19 cases.

The next most common burns are those due to contact with a hot object. This occurred in 33 cases. The child has most often brought its hand or arm in contact with the hot kitchen stove, a portable stove, the doors of an oven, cooking vessels, a hot iron, or something similar. In 4 instances, the child has, during play out of doors, come to touch the hot exhaust-pipes of a motor-car or motor-cycle just brought to stop.

Injuries caused by open fire have taken place in 15 cases. As a rule, the child has managed to set fire to its clothing with matches or a burning-glass. These injuries are usually very serious, involving large parts of the body and, when the course has not been lethal, have left severe physical defects.

In this connection, injuries from electric current should be

mentioned. Children, as well as sick or debile persons, are according to MARTELL (1930) particularly susceptible to this type of injury. MARTELL also draws attention to the fact that in these cases direct current and alternating current are practically equally dangerous. The voltage in the usual electric circuit (viz., 110—220 V) lies within the most pronounced danger area. 8 electric injuries have occurred, 5 of them happening in the way KAMPF (1937) has described and particularly warned against. Thus, the child has crawled about on the floor and has come across a torn wire or broken extension plug. It has put this into its mouth and sucked it. The result has been severe burns on the lips and the tongue and, in two cases, considerable defects in connection with the healing. On two occasions the child has stuck its hand into a broken wall-plug and sustained serious burns with, in one case, the resulting amputation of a finger. Finally, one boy chanced during play out of doors to come in contact with a wire conducting a high voltage current. Thus, 7 of these 8 accident cases have been due to defective material.

At the transition to the age of playing, the child enters a period of pronounced curiosity with regard to its surroundings. In order to satisfy this inquisitiveness, it unconsciously exposes itself to dangers of different kinds. At this age it is very usual that objects are put into the mouth, the nose, or the ears, resulting not infrequently either in the swallowing of the object or in its becoming wedged. This has happened in 195 cases, where the child has come under treatment owing to having put something into its mouth which it has been impossible to recover, since it has stuck or become lodged in the respiratory or digestive tracts. The age distribution of these cases may be seen from Fig. 5. When 360 cases, from CHEVALIER-JACKSON's large table of similar cases from the year 1924, are selected, belonging to the age-group 0—15 years, and an age distribution curve is drawn in the same way, the two curves obtained will be found to be in fair agreement with one another (Fig. 5). In both the materials, the maximum lies within the age of 1 year. However, this type of accident is also common in the age-groups of 2 and 3 years.

The kind of injurious object has been known in 186 of the 195 cases. EMILLER (1933) has demonstrated in a smaller material that, in the majority of cases, metal objects have been concerned. This applies also to the present material. Thus, on 147 occasions, *i. e.* corresponding to 79 per cent of the cases, the object in question has been a metal piece of some kind. 58 of them have been sharp, as, for instance, screws, nails, pins, needles, drawing-pins, hairpins, etc. 86 have constituted blunt metal objects such as

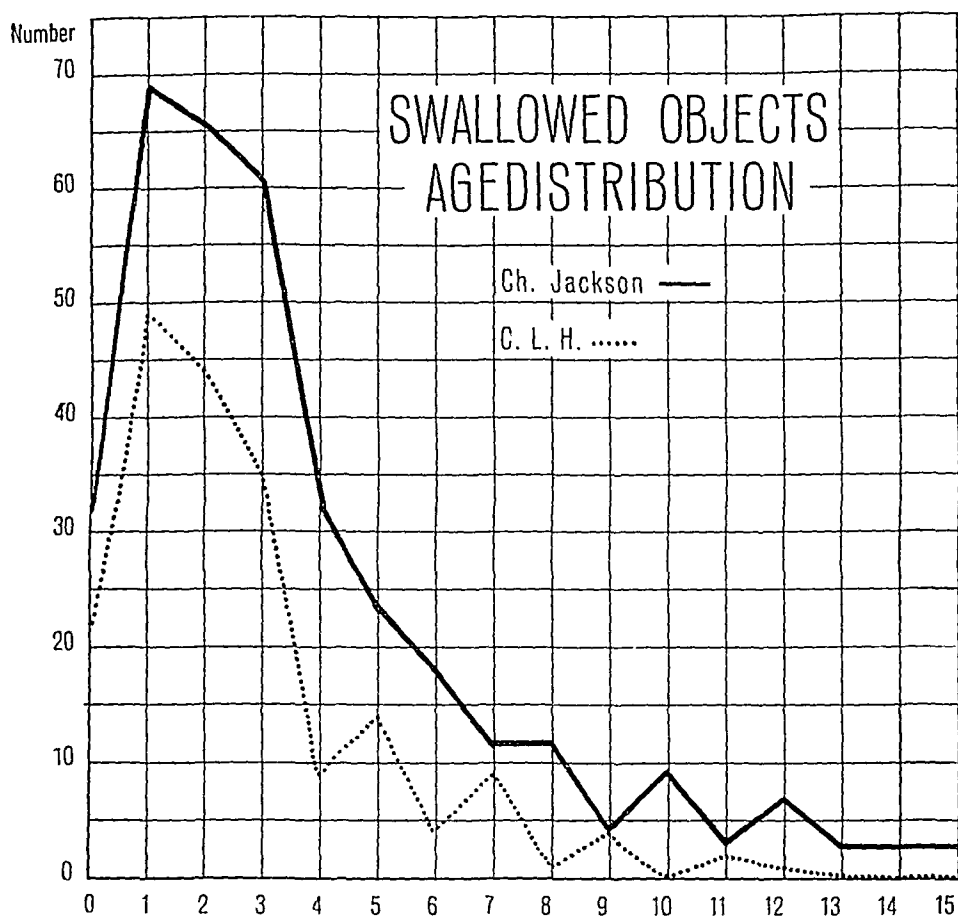


Fig. 5.

metal balls, closed safety-pins, toy parts, and coins, the latter occurring as often as 43 times. As regards the 39 non-metal objects, 21 were sharp pieces of glass, celluloid bits, fish bones whisk twigs, etc., while the remaining 18 represented blunt toy parts, pieces of wood, glass balls, doll's eyes, buttons etc.

In 2 of these 186 cases, the foreign body has stuck in the cavity of the mouth.

In one case the loop of a steel wire had caught between the teeth of a 2-year-old, in another case a 1-year-old had stuck a large block of wood in the back of the oral cavity. The foreign body had stuck in the pharynx 12 times. On these occasions, it was generally a question of thin, sharp objects, such as fish bones whisk twigs, or needles, which had become wedged into the tonsils or palatal arches. Only in one single case had the foreign body found its way into the respiratory organs, *i. e.* a bent pin had become fixed in one of the main bronchi. It should be noted that the material is misleading on this point, owing to the fact that children subjected to this particular type of accident have as a rule been brought directly to an ear-, nose- and throat-depart-

ment. The C. L. H., it is true, had an ear-, nose- and throat-polyclinic up to the year 1939, but this did not prevent a number of children from applying to other polyclinics of this type.

In 16 cases, the foreign body stuck in the oesophagus. All these cases concerned coins, generally, 2-öre pieces. As pointed out by EMILLER, the 2-öre pieces are the type of coin which usually causes complications. Smaller coins such as 1-, 10-, and 25-öre pieces, pass without difficulty when swallowed, and often no attention is directed to this matter. The bigger coins, viz., 5-öre pieces, 1 and 2 crown pieces, are of a size which is normally hard for the child to swallow.

Children have been treated 55 times owing to having stuck some object up into the nose. This has generally concerned glass beads, peas, kernels, drawing-pins and, in a great number of cases sallow buds. These children have obtained rapid help at the polyclinic by means of simple extraction.

In 5 instances, the child has stuck an object, usually a pea or a glass bead, into the external auditory canal. In these cases, extraction is more risky, particularly since some relative has, as a rule, first made efforts to remove the foreign body and, in so doing, has only pushed it further in towards the tympanic membrane.

Injuries due to the fact that the child has swallowed a corrosive fluid of some kind should be mentioned here, being closely connected with the preceding groups. 19 cases have been observed. 9 of them were at the age of 1 year, the rest distributed among the ages of 2—4 years. Acid was the cause once, while in the remaining 18 cases lye was the injurious agent. Most often the child had chanced upon some lye powder or a solution prepared from it for the household washing, which has been kept in an ordinary vessel, such as a bottle of beer or an egg-cup. In the event of a substance containing lye powder the injuries have generally been restricted to more or less superficial corrosion of the mucous membranes of the oral cavity and the pharynx which have not left any very marked defects afterwards. The injuries appearing from strong alkaline or acid solutions have been much more serious. Extensive corrosion injuries have occurred in the oesophagus and in the ventricle, leaving after them grave, permanent defects in the form of scar formations with accompanying strictures.

From the point of view of origin, the intoxication injuries are closely related to the corrosion accidents. 57 cases of this type have been registered. The present material is, however, somewhat misleading in this matter, since some of these cases have been admitted to the medical department of the C. L. H. and have, consequently, not been included in this analysis. The most

usual manner of origin with regard to these injuries is that of the child coming across and consuming some too easily accessible medicine. This has taken place in 23 of the 57 cases, concerning as a rule coughing medicines, sedatives and hypnotics. One of the most common places for keeping the two last-mentioned substances is the drawer in the bedside table which is easy for the child to open. On 17 occasions, chemical washing substances were the cause and, in 8 cases, diluted, non-corrosive acids or alkalis. Also in these cases the various substances have either been too accessible or have been kept in some vessel of every-day use such as a cup or a bottle of soda-water. Smaller children, in particular, are tempted to taste water-colours and coloured chalks, and this has resulted in intoxications in 6 cases. Finally, 3 children have come across and swallowed cigarette ends which has then given rise to symptoms of poisoning. Only 8 of the 57 children had to be admitted to the hospital. However, not even these cases were particularly serious.

There is still another group of injuries where the accident is due to the child's desire to stick objects into its mouth. 33 cases dealt with at the hospital have sustained injuries when falling headlong with a stick or some similar object in the mouth. This has frequently concerned also children in the older age groups at the age of playing, the injuries having been distributed approximately within the ages 1—6 years. So-called "candy-sticks", spoons, canes, wooden swords, and pencils, as well as toy flutes, trumpets, and mouth-organs are met with in this material. More or less profound wounds in the lips and in the cheeks, in the soft palate, in the palatal arches, and in the tonsils, have occurred. An infection has been added in not a few of these cases, complicating and prolonging the course of healing.

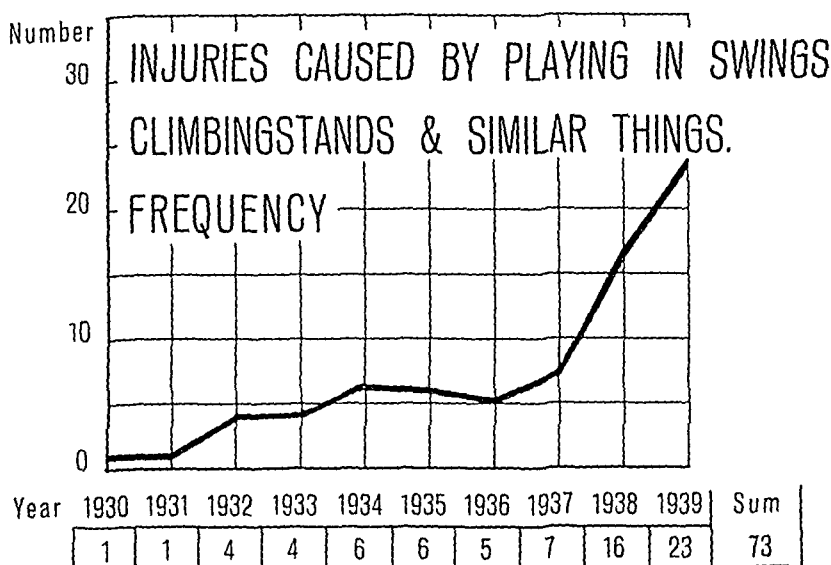
The curiosity with regard to its surroundings peculiar to children is, no doubt, also the cause of accidents at the age of playing, particularly in the first years of this period, such as falls out of bed, or perambulators, etc. This has happened in 115 cases, 56 of them concerning children before 1 year of age. After this, the frequency has decreased within the following age-groups. The falls have often been fairly high and the injuries accordingly of a serious nature. In almost half of the cases, *i. e.* 55 times, a fracture of some kind or other has been noted. At other times, contusions and wounds, often of a more complicated type have occurred. In 9 cases concussion of the brain was ascertained. As is natural in these instances, the injuries have usually occurred in the upper half of the body, 39 being localized to the head, 62 to the upper extremity, and 5 to the upper part of the trunk. Only 9 cases were noted in the lower extremity.

One group of injuries, which has its maximum within the age-group of 2 years, but also is frequent up to the age-group of 5 years and, in addition, appears again at the ages of 10 and 12, is the one due to a fall from a window or balcony. 49 accidents of this type have been recorded. They concern, as a rule, injuries of a more serious character, 32 of the 49 cases having sustained fractures, often multiple ones. 9 of the children were at the age of 10—12 years, the rest being 5 years, or younger. One of the most common causes has been neglect to fix the window-catches properly when closing a window.

All the age-groups reveal injuries due to falls down stairs, in door-ways, lifts, revolving doors, etc. This type of accident occurred 174 times. The injury has often been due to the fact that the child has chosen to play on a staircase from which, owing to lack of caution, it has fallen. This took place in 150 of the 174 cases. In 57 of these cases, a fracture of some kind has occurred, frequently being a clavicle fracture. Concussion of the brain has been the result in 28 cases, the remaining ones being subjected to less extensive wounds and contusions. 21 children have suffered from injuries owing to slamming doors. Small children, in particular, find it difficult to withstand the pressure of the doors of apartment-houses and are, therefore, liable to become jammed in the doorways. Often the effect is increased by the occurrence of a door-shutter, or by the fact that a grown-up passing through the doorway has tried to shut the door after him and thereby considerably added to the extent of the injury. In these cases, vulnerations and contusions have been noted in 21 children, fractures in 4. The injuries have been localized either to the hand or the leg. Accidents in lifts often cause squeezing injuries of a serious type. However, they are rare on account of the generally good safety precautions taken in this respect. Thus, the material has disclosed only 3 such cases.

When an adult is walking and holding a small child by the hand, the child may, not infrequently, trip over and fall, or lag behind for some reason or other. If, then, the grown-up fails to let go off the child's hand, or pulls the child up violently, a tearing, rotatory movement occurs in the arm, causing damage to the shoulder or elbow joints. 116 cases of this type are manifested in the present material. Most of these cases represented either a *subluxatio capituli radii*, or a distorsion in the elbow joint. All of them were met with in children between 1 and 5 years of age.

Very often, at the age of playing, children are liable to fall down during play and sustain some kind of injury, mostly of a less severe type. When indoors, they may slip on the polished



CAUSED INJURIES

		0	10	20	30
Vulnus = 31					
Fractura = 26					
Commotio = 8					
Contusio = 8					

Fig. 6.

floors, stumble over thresholds and toys, knock each other down, or fall from chairs or tables on to which they have climbed, etc. When out of doors, they like to climb on walls and railings, rocks and sand-hills and may, then, frequently fall down from small heights. As a rule, they obtain slight contusions and wounds, but even fractures and concussion of the brain are not rare accidents in this connection.

Several times, and particularly during the last two years of the period covered by the present investigation, the increasing number of swings, climbing-stands and slides set up in the parks and playing-grounds have come to play a part as a cause of injuries (Fig. 6). 73 children have suffered from injuries in this way, 26 of them having obtained fractures and 8 concussions of the brain. The remaining cases have disclosed more or less serious vulnerations and contusions. This has concerned children in the later age of playing and the school-age, in particular. However, the distri-

bution of such accidents is extensive and cases have occurred between the ages of 1 to 13 years.

A form of injury which is not characteristic of childhood but, nevertheless, often happens to children is injuries from bites. 130 cases have been reported. Insect stings (69) and dog bites (39) are the most common kind. The former do not, in the majority of cases, cause any particularly serious injury. However, in one or two cases children in one of the first years of life have been subjected to this type of accident and the reaction had been then very violent. Similarly, grave narrow escapes in the form of attacks of suffocation, or a markedly affected general condition have been noted in a couple of cases of bites in the oral cavity most often due to the fact that the insect has been introduced into the mouth together with a cake or a sweet. On the other hand, the effect of the dog bites has been of a more serious kind. Such a bite invariably involves a great risk of infection. This infection has in fact manifested itself in several cases, causing a prolonged and complicated course of healing and ugly scar formations. The children have been bitten in the head in 16 cases and most often in the face. The upper extremity has been involved in 13 cases, injury to the hand being most frequent. All these injuries have occurred in connection with the child's play with the dog. As regards other bite wounds, the adder bites should be mentioned here, having been reported in 15 cases. According to FREY (1934), the risks at these accidents have been considerably exaggerated and he states the mortality rate as being only 2 per cent. None of the cases accounted for in the present material have been fatal. 14 of the 15 cases have, however, been admitted to the hospital department and all have been given serum. In FREY's opinion, this is the only effective therapy. A more serious complication has not appeared in any single case.

A special form of bite injury is the one occurring when the child falls down and happens to bite itself in the tongue or the inside of the lips. 31 cases of this kind have been registered, all of them uncomplicated, since an infection is rare at this type of injury.

At the time when the child reaches school-age, its environment is considerably changed and, with it, the prerequisites for the occurrence of accidents, in spite of the fact that many of the above-mentioned groups are met with also in this period. The children are, at school, made to keep still for a great part of the day and are not exposed to any particular risks during this time. On the other hand, school gymnastics and sports constitute fields of activity which have not played a part earlier. On the way to and from school, the possibilities of traffic accidents are great,

and especially at the time when bicycles are used. The child's capability of taking care of itself does, of course, increase during school-age, but this is to a fairly great extent counteracted by the recklessness characteristic of the age of praepuberty.

There were 101 accidents occurring during gymnastics, athletics and sports, winter-sports excepted. A continuous rise is observed from 5 up to and including the age of 12, after which the number of cases decreases. At the age of 11 and 12 years, the number of injured boys is considerably more than twice that of girls. 52 of the 101 accident cases have been due to gymnastics, 16 have occurred during athletics, and 20 in connection with hand- or foot-ball games. The remaining 13 are approximately equally distributed among riding, swimming, boxing, wrestling and tennis. In 47 cases, fractures of different kinds have been the result of the accident. Distorsions are more common in this group than otherwise, and are noted in 17 instances. *Commotio cerebri*, on the other hand, is strangely enough rare, and has only appeared on 4 occasions.

177 children have been injured during winter sports. A continuous rise is found in the number of cases up to the age of 6—7 years, after which the frequency remains fairly constant through the remaining age-groups. The most usual causes of accidents in the earlier ages, however, are not similar to those occurring later. The younger children mostly coast, though less than before, using skeleton sleighs. The older ones, on the other hand, devote their time mostly to skiing and skating. The injuries are to some extent dependent on the type of implement employed. At tobogganing, 59 children have sustained injuries, the head and leg injuries having predominated. 10 femoral and 15 leg fractures have occurred. Damage to the arm has been rare. However, arm injuries have been frequent at skating, which has been the cause of the injury in 55 cases. 22 of these concerned the arm, generally owing to falls on the out-stretched arm (*i. e.* according to KNORLACH (1933) the most common type of injury). Femoral fractures are hardly manifested at all, while leg fractures, scratches, cuts and wounds from a pointed implement are frequent. Finally, skating is the most common cause of concussion of the brain among the winter sports. 15 cases having been noted, 2 of which occurred in connection with a fracture of the skull. Accidents in connection with skating, which have happened in 40 instances, have occasioned a leg injury in 29 cases. The femoral and leg fractures are equally common. The remaining 11 had arm injuries, often fractures. Thus, all the injuries have involved the extremities. KNORLACH ascertained in a material comprising over

1,100 cases, 86.5 per cent of extremity injuries among all the accidents during winter sports. Further, CAMPBELL (1937) draws attention to the fact that, at skiing, fractures on the lower extremity are particularly common in childhood. He asserts, furthermore, that the rotation fracture on the tibia is the most usual one. This is in fair agreement with the present material where the majority of the leg fractures actually concern long spiral fractures of the tibia.

For several reasons, traffic accidents form the most important group of childhood accidents. They have undergone a marked increase, particularly since the years just before the second world war. When the traffic again becomes normal, their significance in this respect will, no doubt, become still greater. The injuries sustained are, in several instances, of a severe kind, often being deleterious. Obviously, the intensified traffic, with the increasingly added demands on balance and precision, must conflict with the smaller children's lack of these particular properties. The older children, on the other hand, have a pronounced interest in their surroundings and a quick power of reaction. Therefore, they are highly qualified to take care of themselves in traffic, in fact, more so even than adults. The official statistics reveal this to be in good conformity with actual conditions. Among pedestrians of all ages, who have been subjected to traffic accidents by daylight, the age-group 0—10 years has the maximum number of accidents, while the next higher age-group 10—20 years shows the lowest number. A closer examination of the younger group will disclose the fact that the 4—5 years-olds, apparently, run the greatest risk of traffic accidents and that the frequency then rapidly falls up to the age of 10 years.

461 traffic accidents occur in the material (Fig. 7), comprising 9.1 per cent of the total number of accidents. During the years just before the second world war, *i. e.* 1937—1939, a considerable increase could be noticed in the number of such accidents. A continuous rise in the number of injuries on human beings due to traffic accidents has taken place in the whole country as well as in the city of Stockholm. However, the total rise has been decidedly more pronounced than that which can be ascertained in the present investigations of childhood traffic accidents. Thus, for instance, the total number of traffic accidents with personal injuries in Stockholm during 1939 was almost twice that of 1937. As regards the whole country, the increase from 1937 to 1939 was 60 %. In the present material, the increase during these years has amounted to 20 % of the number of accidents in 1937. Thus, the increase in childhood accidents due to traffic is conspicuous,

ALL THE TRAFFIC ACCIDENTS TREATED AT C. L. H.

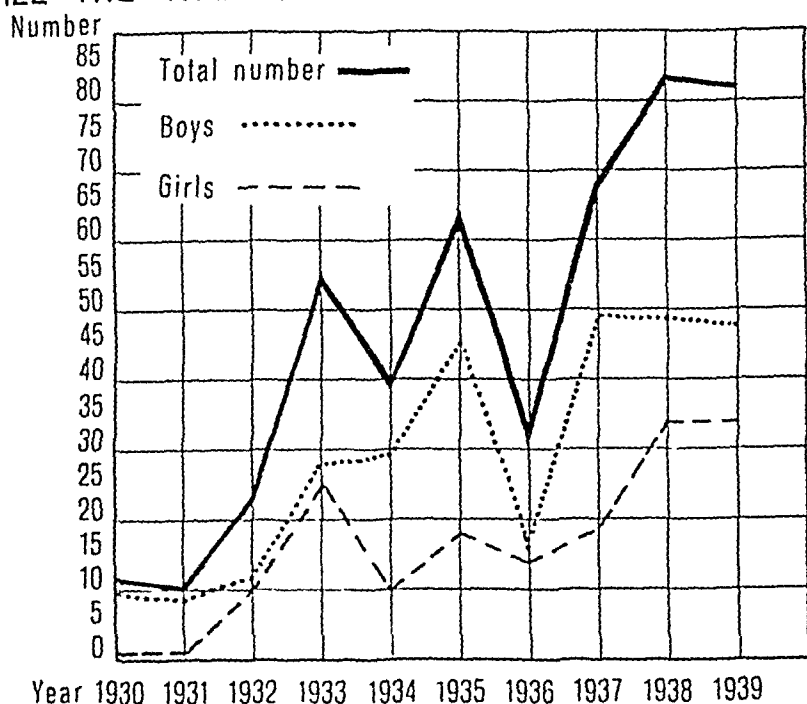


Fig. 7.

though evidently not at all so pronounced as the total number of traffic accidents.

When the figures of traffic accidents in the whole country from the official statistics, distributed over the various months of the year, are compiled, a strong increase will be found, as expected, within the month of May up to and including September. A corresponding compilation of only the Stockholm cases gives a similar distribution, with the exception of a temporary decrease in July. As regards the present material, the distribution resembles that of the official statistics. However, the reduction in the months at the height of summer is, for reasons already stated, more marked.

In the present material, hardly any traffic accidents occur in the lowest age-groups (Fig. 8). A noticeable rise is seen in the 2 year age-group which later becomes considerable in the ages of 3 years up to and including 6 years, where 48.4 per cent of the

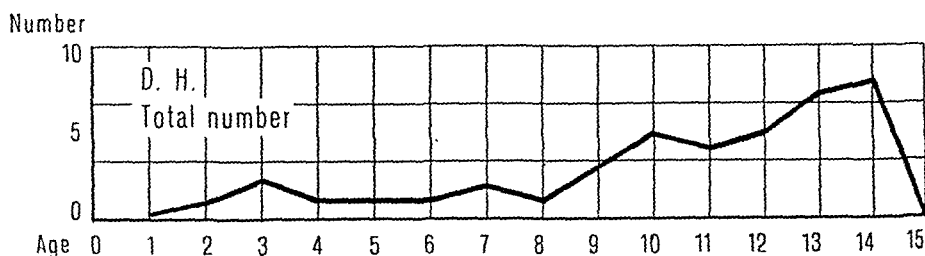
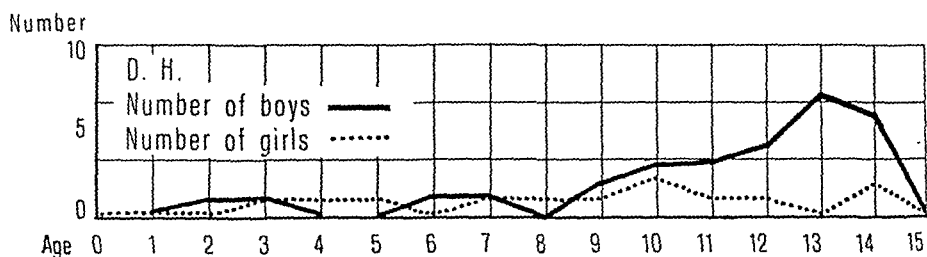
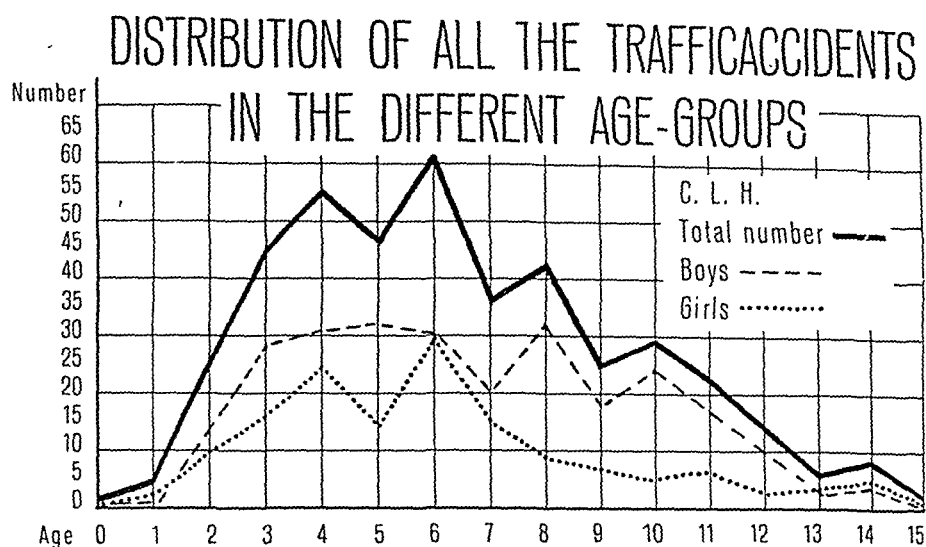


Fig. 8.





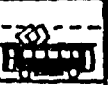



total number are noted. Particularly the age of 6 years seems to be exposed to these accidents. After this age, a reduction sets in, as partly explained above. However, as regards Stockholm this is, no doubt, dependent on the fact that some of the older children are taken care of at hospitals for adults.

The distribution of the traffic accidents with particular regard to their mode of origin is illustrated in Table 4 below.

As may be seen, bicycles cause the majority of accidents (242), next followed by motor-cars (198). However, the more serious injuries occur in the latter case. Generally the accidents take place owing to the fact that the child, in the course of play in the street, happens to come in the way of a vehicle. This particularly con-

cerns the ages 3—6 years. The great majority of motor-car accidents (163), and several of the bicycle accidents (67), have occurred in this way. The other bicycle accidents are distributed in two groups. In 107 cases, the child has been knocked down while bicycling, and sustained an injury. 46 children have been injured when riding as passenger on a bicycle, 29 of which had been placed on the children's seat fastened to the bicycle and, owing to the lack of proper safety arrangements, have got their feet stuck in between the spokes of the wheel. On these occasions, as also pointed out by CARSTAM (1941), not only slight contusions but also a number of more or less serious fractures of the leg were observed.

Table 4.

Circumstances of the accident												
Collisions	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
	42	25	7	9	99	64	-	-	2	1	-	-
	2	-	2	-	15	6	1	-	2	-	-	-
Overtaking	75	32	-	-	-	-	-	-	-	-	-	-
Fallen from vehicle	-	-	-	-	7	5	7	-	2	1	-	-
Injured on vehicle	27	19	2	-	5	3	1	-	-	-	-	3

Finally, light is shed upon the serious character of the traffic accidents, as already pointed out above (severe cranial injuries, fractures on the extremities, injuries to internal organs), by the fact that not less than 337 (*i. e.* 73.1 per cent) of the 461 accident cases in the material have had to be admitted to the hospital for treatment.

A number of less common accident causes occur, usually only represented by one or two cases. However, since the few cases of drowning have been considered of interest in this connection, they will be described, as follows:

Narrow escapes from drowning are common in childhood. However, as mentioned above, these children usually do not get to a

hospital. In our material, only three cases of this kind are found, all without particularly serious defects. One case concerned a girl of 1 year and a half, who had been left alone in the bath for a few minutes by her mother. When the mother returned, the girl was unconscious and with her head under the water. This serves to illustrate the great lack of power in small children of getting out of even very shallow water. If they should fall with the face downwards, they do not, as a rule, make any attempts whatsoever to get out of it but remain still and suffocate. The two other cases concerned boys at the age of 4 years. One of these cases had occurred on a beach, the other at a deep well. All three cases rapidly returned to consciousness and recovered.

The difference between the Stockholm and the Bäckefors materials is marked owing to the fact that the country children take part in the work in the home and in the fields to a much greater extent than do the children of the city. The smallest children have to stay close to their mother while she is occupied with the various household duties. The same possibilities of sending the children to playing-grounds, day-nurseries, and kindergartens do not exist in the country as in the city. Consequently, the Bäckefors material represents a comparatively much larger number of injuries of the kind due to the fact that the child has, while playing around its mother, stuck its fingers into a sausage-grinder, a mangle, a wringing-machine, or come in the way of axes or knives, etc. Thus, 6.7 per cent of the children in the Bäckefors material have been injured in this way. When the children have grown a little older, they are, at a young age, made to assist at all kinds of work and during the busy times of farming, *i. e.* at the harvest, in particular. It is then a question of accidents in the handling of axes, scythes, and saws, in threshing-mills and chaff-cutters, and when tending the cattle and at haymaking. 8.6 per cent of the Bäckefors material is represented in this group. Several times, injuries of a serious type have occurred, such as complicated fractures, cranial injuries and large vulnerations. Thus, a total of 15.3 per cent of the children in the Bäckefors material have, in one way or the other, been injured in connection with the household duties. There is no similarity to this group worth mentioning in the Stockholm material.

A Few Words on the Injuries which Have Occurred and their Treatment.

A compilation of all the injuries which have occurred in the material of 5,083 children shows that the most numerous ones are the various forms of vulnerations (1,067). However, these in-

juries are principally of a mild nature, since the great majority of them have undergone polyclinical treatment. Whenever vulnerations have occurred in children admitted to the department for treatment, another simultaneous injury of a more serious kind has frequently formed the actual cause of the admission. The risk of tetanus has to be taken into account in cases of extensive and deep vulnerations. Possibilities of infections of this type are particularly common in the country, but also appear in the cities and, above all, in the gardens in the suburbs. The material includes two cases of this type. The anti-tetanus vaccination, suggested from French and American quarters and already to some extent tested in Sweden (ERICSSON, H., ADAMSSON, C.-A and ERICSSON, B., 1944), may be recommended straight off. Even though it is possible, at present, to keep the number of tetanus cases on a low level by means of the frequently applied anti-tetanus serum which is at our disposal, it is, however, far more valuable to have such a protection already developed in the children. More-over, the unavoidable increase in sensibility has to be reckoned with, which in many instances at a later serum administration for some other reason has caused serious threats of complications. A combination of diphtheria and anti-tetanus vaccination of all children would be the most advisable procedure.

Next in number after the vulnerations come the fractures (1,336 in number). An analysis of these injuries reveals the pronounced predominance of fractures on the upper extremity, *i. e.* clavicle-, supracondyloid humerus-, and simple forearm fractures, in particular. Also leg fractures and femoral fractures are common while other fracture localizations are less frequent.

The cranial injuries are also common, fractures often being noted in this connection. Among 295 cases subjected to X-ray examination (Table 5), not less than 118 had a fracture of the cranial bones. Furthermore, without doubt, several fractures of a more lenient kind are concealed in the large group of cranial injuries not subjected to X-ray examination, which had been diagnosed as concussion of the brain.

Table 5.
All severe cranial traumas.

Type of injury	Com- motio	Fract. thecae without impression	Fract. thecae with impression	Fract. baseos cranii	Total
X-ray exam. . . .	177	93	18	7	295
No X-ray exam. . .	161	3	—	9	173
Operated cases . .	—	1	6	1	8
Deaths	—	—	2	1	3

The slight frequency of fractures on the basis cranii is conspicuous. 18 of the fractures of the cranial roof had an impression, but only 6 of these cases were subjected to surgical intervention. Mild impression fractures without any local symptoms are, as a rule, not operated upon, since it has been found that they, this notwithstanding, heal without permanent defects. The but slight mortality figure is also noteworthy. In this comprehensive material of cranial injuries only three cases were fatal. As regards treatment, cases with cranial fractures have been treated with bed rest for at least one month, while cases with simple concussion of the brain have only had to stay in bed in the hospital for one week and, possibly, another week at home. This has proved sufficient and no later mental symptoms have been observable. GUTTMAN and HORDER (1943) recommend even in cases of this type only approximately 2 weeks of confinement to bed, and regard it as quite sufficient for complete and permanent freedom from symptoms.

As regards the burns, these injuries have several times been of a very serious character. Earlier, the mortality rate was high, but it was considerably reduced by the introduction of the tannic acid treatment (STANLEY-BROWN, 1935, E. SEVERIN, 1937). However, the risks with regard to the smaller children are still considerable. STANLEY-BROWN states a mortality figure of 17.2 per cent in children under 5 years, in spite of the tannic acid treatment, and notwithstanding the fact that the total mortality in her material had decreased to approximately 10 per cent. In the present material, where the mortality totalled 4.7 per cent, all the deaths happened at an age of less than 5 years which, accordingly, increases the mortality figure in this group to 6.8 per cent.

In spite of the marked reduction in the mortality rate, the prognosis as regards burns cannot be said to be particularly favourable. The frequency of defective healing with disfiguring scars, at times diminishing the capacity of functioning, will probably be considerably lessened by extension and earlier use of skin grafting. However, the tannic acid treatment gives improved healing and makes the scar formations less severe. Thus, considerable progress has been achieved on this point.

When a foreign body has entered into the abdominal and intestinal canal, expectation is advised for as long as possible, since it has been established that the foreign body has several times been capable of passing through the digestive tract without external intervention. Among the 155 cases in the present material, where an accident of this type has occurred, 68 have been available for control with regard to the time of the passage

TIME OF PASSING OF OBJECTS SWALLOWED

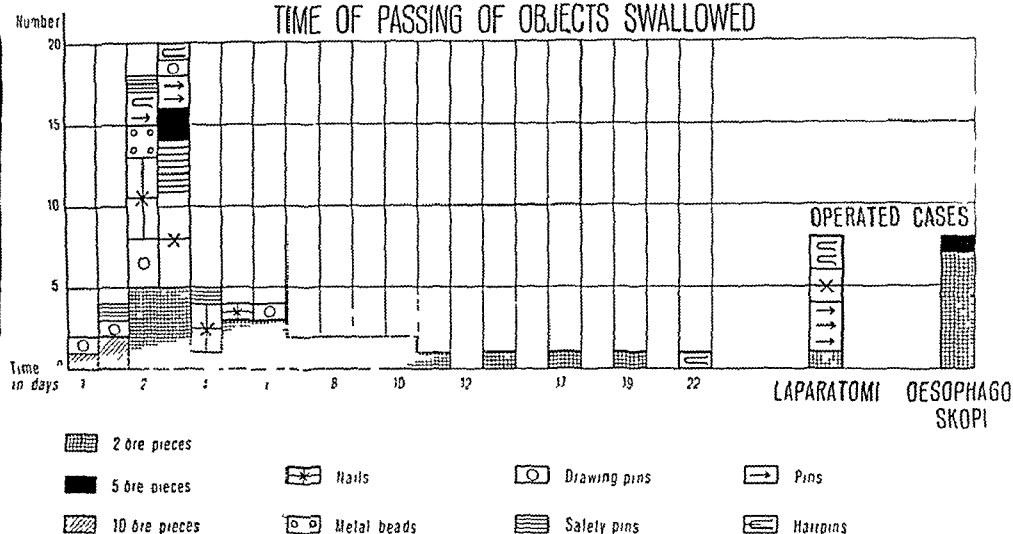


Fig. 9.

through the canal. Variations have been determined from 1 up to 22 days (fig. 9). 6 objects were ejected as soon as after 1 day, 18 after 2 days, and 20 after 3 days. Most of the smaller objects were among those ejected early, as well as the majority of the nails, screws, pins and similar objects. A good third of the coins were discharged during these first three days. As for the other objects, passage took a longer time and they were observed to be ejected on the 11—19 days. The longest time of passage was taken by a hairpin, which was not recovered until on the 22nd day. Thus, expectation can, no doubt, be recommended for a relatively long stretch of time and, provided careful control has not disclosed any disturbing symptoms, it may be prolonged for 2—3 weeks. In order to hasten the passage of these objects, the children have of late been given an abundance of asparagus (QUIST, 1945), causing the objects to become ensnared in the stringy masses and they have thus been discharged more rapidly and with less risk.

The surgical extraction of objects which have become wedged has been necessary in only 16 cases. Even in these instances, a somewhat prolonged period of expectation may, possibly, have been justified. Coins were found in 8 cases (7 being 2-öre pieces) which had stuck in the oesophagus and were recovered by means of an oesophagoscope. In this connection, the possibility of making an erroneous diagnosis deserves to be mentioned, which may take place owing to the localization of foreign bodies in this organ. This was last pointed out by SANDSTRÖM (1945). Foreign bodies in the oesophagus may give rise to anorexia and feeding

difficulties of long duration with accompanying mental injuries. Furthermore, a long time may elapse before any investigation is made of the possibility of a foreign body in the oesophagus. When found, its removal will rapidly cause relief from these symptoms. The remaining 8 of the above-mentioned 16 objects which had to be extracted surgically concerned one 2-öre piece, 3 pins, 2 nails and 2 hairclasps. Their removal necessitated opening of the stomach or the intestine. The fixed bends in the duodenum, in particular, present difficulties for the passage of such objects as, for instance, hair-fasteners. PERSLOW (1935) states that objects which are pointed at either end are especially liable to fasten during passage through the abdominal-intestinal canal. 2 of the 8 last-mentioned objects were of this type in the present material.

Some Prophylactic Measures.

As already pointed out in the introduction, the part played by the grown-up is of great significance with regard to the origin of childhood accidents. The sensible conduct on the part of the parents or nurses would frequently eliminate the risk of accidents and protect the children from disastrous or invalidating mishaps. Notwithstanding care and attention, children can never be entirely kept safe from accidents. Should this be possible, however, the advantages of altogether eliminating this risk would, nevertheless, be questionable. The accidents during childhood have an educational value, contributing in their way towards creating an individual fit for life and strengthening its power of resistance. Curiosity and the love of adventure should not be checked too strongly. The children must learn to realize the various risks and develop their own power of reaction. However, there is a fundamental difference between the slight injuries, unavoidable when relying on a sense of self-responsibility in the child, and the grave accidents which are, in the last place, due to carelessness or neglect on the part of those in charge or of the community.

The present housing and living conditions are of great significance in this respect. The space in the apartments is limited, and the kitchen often has to serve as a nursery. When the children are out of doors, the street is their only retreat. Thus, the burns, for instance, are intimately connected with the household duties, as mentioned by FASAL (1935). An intensive propaganda on this subject, with particular emphasis on the great risks run by especially the smaller children, should be the most advisable procedure. Not until mothers and other persons working in the private homes have actually realized the immense risks involved by burns, can an improvement be expected.

The same applies to injuries due to the fact that the children have swallowed a corrosive fluid of some kind. These accidents could be avoided very easily, provided only the necessary precautions were observed in the homes with regard to these substances, and particularly concerning their safe keeping. When, as in the material dealt with here, one and the same child has been admitted to the hospital owing to an accident of this type on two separate occasions recourse to legal proceedings and extensive publicity must be taken into consideration as, perhaps, the only effective method for obtaining an improvement.

The same applies to poisoning by medicaments and other intoxications. It is not merely everyone's duty, but also legally imperative, that medicaments and such matter are kept out of reach of children and shut up in cup-boards. According to the new poison regulations, it is punishable to keep, for instance, sleeping tablets and other poisonous medicaments in, *e. g.*, a drawer in the bedside table. Information of this kind must be brought to the knowledge of the public. A propaganda should be carried on in order to sort out from the private homes all the old medicines which have been left for no purpose for months and even years and, when carelessly kept, constitute a permanent danger to the children in the family. Even seemingly innocent objects may involve great risks. At the period when the child wants to stick every new object it comes across into its mouth, it should not be given coloured chalks or water-colours. The swallowing of such substances may give rise to severe poisoning. Special attention should be paid to aniline pencils. Aniline poisoning is, as a rule, very serious and cases with a deadly outcome are not so rare (JOSEFSSON, 1945, among others). Furthermore, caution is advised with regard to leaving cigar- and cigarette-ends about within reach of the children. Such a prophylaxis is comparatively easy indoors. But, since the children may find such matter even out of doors, they must, as far as possible, have been taught not to touch these things.

Careful control of and the rejection of inferior electric material would eliminate a great number of injuries. However, the accidents remain where the child has found current-conducting joint-wires and plugs on the floor and has stuck them into its mouth, and where they have inserted their fingers into wall-plugs. By the general use of automatically safe plugs and extension wires and by prohibiting the employment of other materials, also these usually severe injuries would be reduced to a minimum. The placing of all electric material out of reach of children is, for aesthetic reasons, out of the question.

The frequency of swallowed foreign bodies could be counter-acted by a sensible choice of toys, adapted to the age of the child. Toys with small, perhaps sharp edges or pointed parts, should be kept for the older children. Teddy-bears and other toy animals should not have eyes of small glass-beads, fastened least of all by a long pin, embroidered eyes serving the purpose just as well. The toy manufacturers must be brought to cooperate on this point. In fact, there have been indications of a will to do so on the part of these manufacturers as far as these dangerous teddy-bear eyes are concerned. Precaution as regards safety-pins, pins, nails, drawing-pins, etc., is also of vital importance. Above all, infant clothing which does not, as far as possible, necessitate the use of pins is desirable in this connection.

The injuries by fall can often be altogether blamed on the want of judgement and lack of attention of those in charge of the children. The children should be left alone as little as possible in the apartments. Window-catches should always be fixed, and a strong metal grating should be applied to at least the lower half of the window of a nursery or day-nursery, and similar places. The doors of balconies must be locked. Chairs and stools should not be left standing close to a window or on a balcony. The bed should not be too high, but adapted to the child, so that it can take itself out of it without falling. The smaller children should have high gables all around their bed. Harnesses may, on the other hand, be unsafe. Even the best models, from a theoretical point of view, may be wrongly adjusted and accordingly dangerous.

When the child grows older, the types of injuries increasingly resemble those of grown-ups and the injuries characteristic of childhood tend to disappear. However, certain stipulations are of importance also at the higher age-groups.

Injuries due to gymnastics and sports are by no means rare. However, it is strange to note that these obtained during gymnastics are the most common, while those occurring during football games, athletics, etc., are considerably less frequent. The risks of accidents during gymnastics seem to increase with the use of apparatuses. Thus, it is desirable that those conducting and in charge of these exercises, should be instructed to pay careful regard to this matter. In this connection, attention should also be paid to all the modern apparatuses in the parks and playgrounds. These slides, climbing-stands, swings of various kinds and round-about are not at all free from risks and accidents are frequent. In so far as grants are given by the authorities for the purchase and arrangement of the required equipment, means must, as a matter of course, be provided for continuous, proper

supervision. If the latter condition cannot be fulfilled, apparatuses of this type should not be placed to public use, considering the obvious risks of accidents.

Finally, the traffic accidents deserve particular attention. Many children have to resort to the streets for playing and, with increase of age and the beginning of school, they are included as important factors in the large traffic machinery. The traffic authorities are urgently striving to solve the enormous problem of directing a continuously increasing motor-traffic through still old-fashioned communities built for a less speedy mode of conveyance. The year by year steadily swelling crowd of cyclists also contributes to these difficulties. Much has, of course, been done already to protect the children in these parts, but this is far from enough. Untiring attempts must be made without interruption to teach particularly the city children at an early age to become traffic-minded. Even the small children must be taught to understand the great danger of a motor-car or motor-cycle rushing down a street or country-road. Inter alia, object-lessons with picture-books may early awake a traffic sense in these cases. Group games in the day-nurseries and in the nursery gardens may serve the same purpose. A great deal of work must be devoted to this information, since the children in the lower age-groups may easily and without thinking follow the impulse of the moment and, for instance, rush straight out into the traffic after a lost ball. Later on, the part played by the school must be intensified in this respect and much attention must be directed towards this subject. This was realized by the authorities several years ago, when they issued circulars on traffic education in the schools (1936). These instructions must, however, now be brought up to date again. Furthermore, the children should not be given bicycles until they actually need them (for instance, a very long distance to school), or before they are mature enough to go alone in the traffic. This hardly takes place until the age of 10—12 years. When the children have been given bicycles, these vehicles should be subjected to continuous supervision, so that no vital parts are defective or for some reason or other out of function. No bicycle should be without a hand-break. This should be stipulated by the authorities. The construction of children's seats is far from satisfactory, as is clearly visible from the accidents due to them. It is possible for a child to get its foot caught between the spokes of the wheel and this may entail grave injuries. Still severer injuries may happen when the child is placed directly on the rack of the bicycle. Simple safety arrangements, such as, for instance, oil-cloth shields at the side of the wheels, may be

sufficient to prevent an accident. Also the manufacturers of children's seats must contribute in this respect and conscientiously make efforts to construct safe models for them. The proposed traffic regulations of 1944 included a suggestion that the use of ordinary racks as seats for children should be forbidden. However, no regulations with regard to the conveyance of children on bicycles have been published. This must be considered a serious defect.

A study of the causes of childhood accidents and an attempt to find means of reducing their frequency, will lead to the conclusion that the main source lies in certain social conditions. The environment in which a child grows up is of the utmost significance, as is also the personal feeling of responsibility and thoughtfulness of the parents and those in charge, particularly with regard to the younger children. Ultimately, the housing and living standard may become decisive factors. As pointed out by EDBERG, many childhood accidents, mild as well as serious ones, may be attributed to bad social conditions, such as insufficient urban planning, over-crowding, inferior dwelling-places, unpractical and unmodern household arrangements, the mothers' occupation outside the home, etc. Several children have to resort to court-yards, streets and roads for playing. Many are deprived of the mother's care for the greater part of the day at an early age.

Improvements in the present conditions can only be achieved by means of social reforms. Restricted measures will only be palliatives. Wellplanned housing, where proper regard is paid to children in different respects, as well as a well-planned road system with numerous playing-grounds form important considerations. In so far as the official authorities are in a position to assist the private homes in this and similar ways, the parents and others in charge will find it easier to master the difficulties in this respect and many stipulations, now insufficiently observed, will then seem simple and natural.

Summary.

An examination has been carried out comprising 5,083 children subjected to accident injuries. The casualty frequency is lower among girls being only half or a third of that of the boys exposed to injuries. Mortality is low, only 22 children have died, 10 of which from burns, the most frequent and at the same time the most dangerous of the injuries of early childhood. During infancy and childhood accident injuries are most commonly caused by lack of care on the part of those in charge. During the later part

of the age of playing the child itself often contributes to cause the accident. At the age of six the greatest number of traffic-accidents occur. During school-age accidents which happen when the children are practising gymnastics or wintersports are added.

The most common type of injuries are contusions and fractures. Infants and children of the younger age-groups hurt their heads above all, and the upper extremities, children of the older age-groups also hurt the lower extremities to a large extent.

The prognosis of accident injuries during childhood is as a rule good. If the child only overcomes the shock connected with the accident the healing-conditions are generally exceptionally favourable and the final outcome often amazingly good.

Zusammenfassung.

Es ist eine Untersuchung vorgenommen worden, die 5,083 von Unfällen betroffene Kinder umfasst. Die Unfallsfrequenz ist bei Knaben 2—3mal so gross wie bei Mädchen. Die Mortalität ist gering — nur 22 Kinder sind gestorben, davon 10 an Verbrennungen, die die gewöhnlichsten und gefährlichsten Unfallsverletzungen des Kleinkinderalters darstellen. Im Säuglings- und Kleinkinderalter sind die Unfälle zumeist durch mangelhafte Fürsorge seitens der Umgebung bedingt. Im späteren Teil des Spielalters trägt das Kind selber oft dazu bei, den Unfall heraufzubeschwören. Im Alter von 6 Jahren kommt die grösste Anzahl von Verkehrsunfällen vor. Im Schulalter kommen Unfälle hinzu, die bei der Ausübung von Gymnastik und Wintersport eintreffen.

Die gewöhnlichsten Typen von Verletzungen sind Kontusionen und Frakturen. Säuglinge und Kleinkinder verletzen vorwiegend Kopf und obere Extremitäten, ältere Kinder in grossem Ausmasse auch die unteren Extremitäten.

Die Prognose bei Unfällen im Kindesalter ist in der Regel eine gute. Wenn das Kind nur über den mit dem eigentlichen Unfälle hergehenden Schock hinwegkommt, so sind die Heilungsbedingungen zumeist ausserordentlich günstig und das Endergebnis oft erstaunlich gut.

Résumé.

L'enquête a porté sur 5,083 enfants victimes d'accidents. La fréquence de ceux-ci est de deux à trois fois plus grande pour les garçons que pour les filles. La mortalité est basse, car seulement 22 enfants sont morts, dont 10 de brûlures, qui sont les lésions accidentelles les plus courantes et les plus dangereuses de

la petite enfance. Chez les nourrissons et les enfants en bas âge les accidents sont dus le plus souvent à un manque de soin de la part de l'entourage. Dans la seconde partie de la période préscolaire l'enfant contribue bien des fois lui-même à causer l'accident. C'est à l'âge de 6 ans que se produisent la plupart des accidents de la circulation. A l'âge scolaire s'y ajoutent les accidents de la gymnastique et des sports d'hiver.

Les types de lésions les plus habituels sont les contusions et les fractures. Les nourrissons et les petits enfants se blessent avant tout à la tête et aux membres supérieurs, les enfants plus âgés le font, et dans une large mesure, aux membres inférieurs aussi.

Le pronostic des accidents de l'enfance est en général bon. Pourvu que l'enfant surmonte le choc lié à l'accident lui-même, les conditions de guérison, dans la règle, sont extrêmement favorables et le résultat final est souvent étonnamment bon.

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Peripheral Injuries to the Spinal Accessory Nerve.

By

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The main purpose of the present paper is to draw attention to the occurrence of invalidating pains in the shoulder and in the arm of patients suffering from paresis of the spinal accessory nerve. These pains seem to have been completely overlooked, no descriptions having been presented in available handbooks and special works on the subject, as far as I have been able to find out. However, a study of this affliction is called for, considering the frequency in the present material, viz., 16 cases, and also the fact that these pains have, in several instances, rendered the patient unfit for work. Thus, paresis of the spinal accessory nerve is not the innocent complication to surgical interventions hitherto assumed. A brief account of the clinical picture of this paresis will therefore, undoubtedly, be worth while.

Anatomy.

The spinal accessory nerve leaves the skull cavity together with the vagus nerve through the jugular foramen. The point of issue corresponds to a spot right between the angulus mandibulae and the mastoid process. The nerve runs medially to the posterior belly of the digastric muscle close to the internal jugular vein which it crosses ventrally in 2 cases out of 3, otherwise dorsally. Just below the lateral mass of the atlas, it reaches the inferior surface of the sternomastoid muscle. It emits motor fibres to the muscle, passes underneath it or penetrates its deep head, reappearing under its posterior edge on the border between the upper and middle third part. The nerve then proceeds through

the posterior triangle where it lies superficially just under the skin. It branches off and penetrates into the trapezius muscle.

The sternomastoid and the trapezius muscles are double-innervated. They also receive nerve fibres from the cervical nerves. C 2 and C 3 innervate the sternomastoid muscle, while C 3 and C 4 innervate the trapezius. The exact innervation areas of the spinal accessory nerve and the cervical nerves have not been determined. At times, a marked development of the spinal ac-

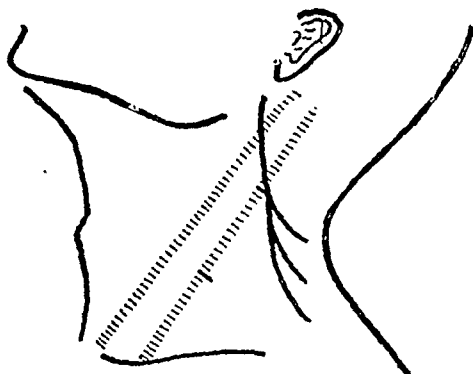


Fig. I.

cessory nerve has been seen to be accompanied by a weak development of the cervical nerves, and vice versa.

The sternomastoid muscle emerges from the mastoid process, and inserts with one head on either manubrium of the sternum and the clavicle. It rotates the head to the opposite side. The superior portion of the trapezius muscle runs from the superior nuchal line of the occiput and its external protuberance and the ligamentum nuchae, its remaining part passing from the spines of the neck and chest vertebrae. The muscle fibers converge to the lateral part of the clavicle, to the acromion and spine of scapula. Trapezius lifts scapula and the lateral end of the clavicle. It adducts scapula to the spinal column. By fixing the scapula trapezius makes its rotation possible when the arm is elevated outwards over shoulder level.

Reasons for the Lesion.

The lesion of the spinal accessory nerve is, above all, due to surgical interventions, mostly removal of a tuberculous lymphoma. In his material of lymphoma patients, WULFF (1941) observed pareses of the spinal accessory nerve in 3 per cent of the cases.

He quotes HANFORD (1933), who found 13 pareses among 131 cases, and assumes that the nerve is injured to a far greater extent than can be seen from earlier statistics. Sometimes the nerve is damaged at a biopsy. Now and then violent contact with a blunt instrument may affect only the accessory nerve. KRAMER (1922) reported 13 cases from the first World War of isolated shot injuries to the spinal accessory nerve in a material otherwise comprising 46 lesions of the facial nerve and 50 of the trigeminal nerve. The nerve may also be drawn into the periadenitis round an inflammatory or malignant gland.

In the present material, the paresis occurred in 6 cases at the operation of tuberculous lymphomas of the neck, in 4 cases of undefined lymphomas, in another 4 at biopsy, in 1 case at section of the scalene muscle, and in 1 case the patient got the lesion accidentally when he stepped through a ladder carrying a wooden beam across the shoulder.

Symptoms.

As an illustration of the symptom picture, a detailed account will first be given of a typical case. The other cases are reported in table 1.

Case 1. Unmarried shop-assistant, aged 24. Earlier in good health with the exception of cervical lymphoma. On Nov. 5th, 1942, a tuberculous gland was extirpated by section along the anterior border of the sternomastoid muscle. Immediately after the operation the patient was subjected to pains in the shoulder and the arm-pit. She associated them with the surgical wound and hoped the pains would pass. She was, however, subsequently troubled by them to such an extent as to be unfit for work. She did not consult a doctor until 4 months after the injury. Atrophy of the sternomastoid and trapezius muscles was then pronounced. At operation on March 15th, 1943, with detachment of the nerve, the latter was found completely severed and, accordingly, sutured. In the following months, no subjective improvement occurred. She suffered from continuous pains with a dull ache round the shoulder and out in the arm. The pains radiated along the radial as well as the ulnar side. The fingers became numb, "felt as when swimming in cold water". The numbness was equally marked in all the fingers. Her fingers were not cold. When she tried to lift something the pains increased and she also felt a cramp and pricking sensations round the shoulder-blade. After having gone to bed in the evening, she often felt the pains for several hours before she was able to sleep. During the summer she improved somewhat and tried to help temporarily in her father's shop. In August, she resumed her ordinary work as an assistant in a confectionery. She could not hold her arm

out from the side but had to press the upper arm to the body. It was very tiring and a hindrance. In spite of occasional severe troubles, she has since been able on the whole to attend to her work. Her condition has remained unchanged. She had previously taken a course in office work and attempted to change over to this kind of work but had pains both when she wrote on a type-writer and by hand. She feels a pain in the same way in other work where the arm has to be held in an elevated position, *e. g.*, when sewing. Furthermore, she finds difficulty in holding a needle owing to the numbness in her fingers.

Physical examination on March 14th, 1945:



Fig. 2. Right-sided paresis of the sternomastoid and trapezius muscles. The right shoulder lower than the left. The clavicle is more apparent, its sternal end forming a moderate elevation. The supraclavicular fossa more marked. The head is held in a slight torticollis position with the chin drawn over to the injured side.



Fig. 3. Abduction: The shoulder glides forwards, the supraclavicular fossa forming a deep cavity, the trapezius muscle delimiting it posteriorly in the shape of a sharp but narrow ridge.

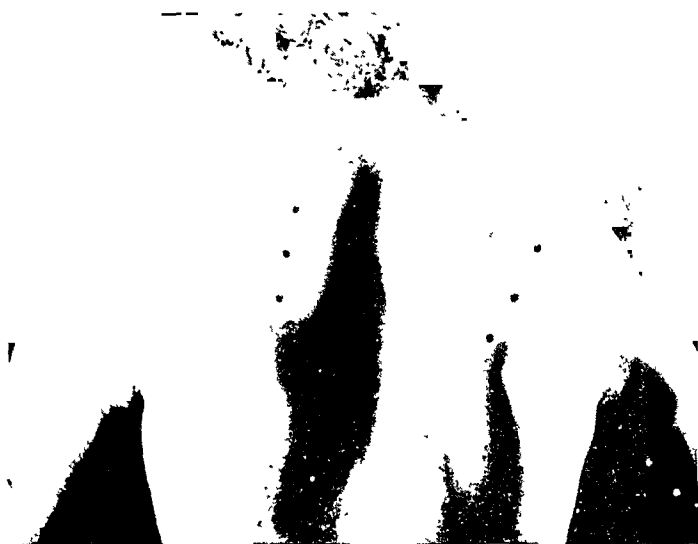


Fig. 4. Depressed scapula with outward dislocation from the spinal column. The dislocation is most marked superiorly.

The patient has a scar in front of the sternomastoid muscle. This muscle is completely atrophied. The rotation of the head towards the healthy side is but slightly restricted, being normal to the injured side. The superior part of the trapezius muscle is partly paralyzed. The capacity to elevate the scapula is considerably reduced. The middle and inferior part of the trapezius are altogether paralyzed with pronounced atrophy. The arm can be lifted to the horizontal plane, but she can only hold it there for a short while. The whole right arm is weaker than normally, but no pareses and no atrophy are ascertainable. The arm reflexes are normal. Normal sensibility. No trophic disturbances. Normal, equally large deflections in the oscillogram in both arms. No clinical or X-ray findings from the shoulder joint.

The subjective symptoms:

Paresis: The patient notices, mostly a few days or a week after the lesion, that the arm feels heavy and queer, and it is impossible to lift it in order to comb the hair or put on clothes, Nor is it possible to lift the shoulder. After a time, the patient observes in the mirror that the shoulder is lowered and that the clavicle has become more prominent. The force of the arm has deteriorated.

Pains: Sometimes the pains are manifested from the start, but as a rule they do not appear until the patient has begun to move about and resumed work. The majority are subjected to pains sooner or later. Out of the 16 patients, 14 suffered from pains. It is a dull aching feeling. 10 patients described it as severe, in-

Table 1.

Case num., sex, age, occupation	Cause of nerve lesion	Symptoms	Extent of troubles	Capacity for work	Physical examination	Remarks
Case 2. Woman, aged 40. Teacher.	Op. of tbc.-lymphoma on the right side of the neck at age of 33.	After a few days, tired in the arm with an aching feeling and pricking sensations from the neck to the shoulder and the arm. In the first year, continuous pains, then pain at exertion.	Severe pains, particularly around the shoulder.	Reduced. Difficulty in writing on the blackboard and when giving instructions at gymnastics.	Paresis of sternomastoid and trapezius. Abduction 45°. Normal sensibility. No trophic disturbances.	
Case 3. Man, aged 36. Time-keeper.	Op. of lymphoma on the right side of the neck at age of 31.	Shortly after op., dull aching feeling around the shoulder, down to the scapula and up the neck. At first continuous pains, then pain at exertion.	Pains at the slightest exertion.	Bad.	Paresis of sternomastoid and trapezius. Reduced power of the arm. Decreased sensibility in the neck. No trophic disturbances.	
Case 4. Man, aged 68. Mechanic.	Op. of tbc.-lymphoma on the right side of the neck. at age of 25.	No troubles, but noticed since then a weaker right arm than left.	—	Normal.	Paresis of trapezius. Normal radialis pulse. No trophic disturbances.	
Case 5. Man, aged 57. Civil engineer.	Op. of tbc.-lymphoma on the right side of the neck at age of 16.	As soon as he got up after the op., had an aching feeling in the scapula, particularly along	Moderate pains.	Moderately reduced. The numbness in the fingers at writing etc. very troublesome,	Paresis of sternomastoid and trapezius. Slight torticollis. Normal radialis pulse. Normal	Syphilis at age of 22. Treated with salvarsan and malaria. No clinical symptoms. W. R.

Case 6. Man, aged 31. Civil engineer.	Biopsy of infectious mononucleosis gland on the right side of the neck at age of 27.	the medial edge, was tired in the shoulder and the whole of his arm. All the fingers became numb when writing or drawing. The numbness often remained for several days.	When the sutures were removed, a strange feeling over the shoulder. 3—4 weeks later, an even intense itching feeling and pricking sensations in the right shoulder, radiating down to the elbow on the outer side of the upper arm.	Intense ache whenever the arm hung freely, was unable to walk owing to these pains.	hand-writing deteriorated, difficulty in doing mechanical drawings.	sensibility. No trophic disturbances. Normal arm reflexes.	in blood neg.
Case 7. Woman, aged 37. Nurse.	Biopsy of gland on the right side of the neck in fever of unknown origin at age of 33.	After a few days, severe pains radiating outwards from the shoulder down the arm to the 2nd and 3rd fingers and slightly in the thumb. Cold in the arm and hand. After a few months, tenderness and stiffness in the shoulder.	Severe pains.	Almost unfit for work. Assisted at broad loom where only the healthy arm has to be used.	Moderately reduced. Particularly obstructive when surveying.	Paresis of trapezius which had healed completely at exam. 3 years after op.	Nerve suture 4 weeks after injury. Good healing, but troubles during the following year. Next 2 years pain at exertion.
						Paresis of trapezius. Abduction 75°. Slightly decreased rotation in the shoulder joint. Normal oscillogram. Sensibility: Mod. deterioration in touch and pain radially on the back of the hand. Arm reflexes rather faint, but otherwise normal and similar to the left arm.	Suture of central stump of n. XI to cervical nerve (the peripheral XI was not found) 1 1/2 years after the injury. No recovery. Transient effect of X-ray treatment of peri-arthritis of the shoulder.

Table 1. (Cont.)

Case num., sex., age, occupation	Cause of nerve lesion	Symptoms	Extent of troubles	Capacity for work	Physical examination	Remarks
Case 8. Man, aged 25. Farm-labourer.	Op. of the-lymphoma on the left side of the neck at age of 21.	2 months after op. a severe dull ache in the shoulder, later in the whole of the arm out in the hand and all the fingers, toward the back and upwards to the neck.	Severe ache, which grew worse at movement. Pains when the arm hung freely.	Unfit for work.	Paresis of trapezius, particularly the superior part. Abduction 89—90°. Power of arm reduced. Sensibility on the neck reduced. No trophic disturbances. Normal arm reflexes.	Fell ill during military service. Indemnity for 1 year. Loss then estimated by the State Insurance Board at less than 10%, i. e. <i>not entitled to compensation.</i>
Case 9. Woman, aged 51. Fur seamstress.	Op. of lymphoma on the left side of the neck at age of 50.	After 1 week, she had an aching feeling from the neck up to the ear and downwards to the shoulder and the upper arm with numbness in the fingers. Also an aching feeling round the scapula.	Severe very irritating ache.	Much reduced. Unable to perform any work where the arms must move quickly.	Paresis of trapezius, normal radialis pulse. No trophic disturbances.	
Case 10. Woman, aged 27. Hospital-maid.	Op. of lymphoma on the right side of the neck at age of 23.	Noticed shortly after op. a dull aching feeling from the neck down to the shoulder and the scapula.	Severe ache at first, which subsided when she was given easy work.	Moderate decrease.	Paresis of trapezius which had healed completely at exam. 3½ years after op.	Nerve suture 9 months after injury. Consulted a doctor chiefly for cosmetic reasons. Good healing with normal musculature after 1 year.

Case 11. Woman, aged 38. House- maid.	Op. of the lym- phoma on the right side of the neck at age of 34.	Noticed immediately after op. that some- thing was wrong with her right shoulder. Later ache in the scapula re- gion, in the arm- pit and out along the outer side of upper arm, as well as in the forearm and the 4th and 5th fingers.	Moderate pain resembling mild tooth- ache.	Reduced. Can only perform house- hold work for a short while. Has tried to develop her strength but only gets worse.	Paresis of sterno- mastoid and trape- zius. Normal ra- dialis pulse. Nor- mal sensibility.	Relief from pain when arm is placed upwards and back- wards, e. g., on back of a chair, when she rests her hand on the hip — has worn out her clothes there.
Case 12. Man, aged 24. Worker in building trade.	Accidentally stepped through a ladder when carrying a wooden beam on the shoulder at age of 18.	Noticed after half a year, that the arm became weaker, had pains in the form of pricking and thrilling sensations in the shoulder and down to the sca- pula.	Moderate pain at mild exer- tion at first. Later only at heavy work.	Somewhat reduced at first, then only troubled by fa- tigue in the arm when he had to work with it in upward position.	Paresis of trapezius. Able to lift the arm outwards and upwards. Normal radialis pulse and sensibility. No tro- phic disturbances. Normal arm re- flexes.	X-ray of neck, spine and shoulder nor- mal.
Case 13. Woman, aged 30. Domestic servant.	Op. scalenotomy on the right side of the neck at age of 27.	The pains from be- fore the op. re- turned in much severer form. Ache and pricking sensa- tions from the shoulder through the whole arm and all the fingers which were numb.	Severe pains particularly when she tries to lift some- thing. Feels as though some- body was squeezing the muscles of the arm.	Considerably re- duced both in se- dentary and non- sedentary work. Pain at needle- work and dar- ning of socks.	Paresis of trapezi- us. Normal radialis pulse and sensi- bility. Arm reflexes normal	Since the age of 14 pains in the arm. Oscillogram: Small deflections bilater- ally. At op. the artery was found to be moderately jammed. No oscillo- gram taken after op.

Table 1. (Cont.)

Case num., sex., age, occupation	Cause of nerve lesion	Symptoms	Extent of troubles	Capacity for work	Physical examination	Remarks
Case 14. Woman, aged 50. Teacher in cookery school.	Op. of lymphoma on right side of the neck at age of 46.	On the following day she noticed that she was unable to lift the arm to comb her hair. After a week, a burning and stinging sensation in shoulder region, down the back to the waist, like lambago, and forwards down the chest. A little later, an aching feeling radiating down the arm along the ulnar border to the hand and to the little finger, at times all the fingers were equally involved, and became numb.	Varying between very severe and mild.	Considerably reduced. Unable to carry or lift. When doing needlework she has to sit with the body markedly inclined backwards with support for the arm by cushions.	Paralysis of trapezius. Reduced motility in the shoulder joint. Abduction 60°. Normal sensibility and arm reflexes.	The periarthrititis of the shoulder given X-ray treatment without effect. Reported vascular cramp in feet and legs at exertion mitigated by cold water. No such symptoms from hands or arms.

Case 15. Man, aged 59. Filer.	At age of 57, ex- tirpation of gland on right side of the neck. P.A.D.: Metastasis? Sarcoma?	3 days after op. strange feeling in the shoulder region, unable to lift the arm, difficulty in dressing. After 1 month when he was able to move more freely aching feel- ing along the me- dial edge of the scapula and out in the arm to the el- bow. The pains were localized all round the arm.	Severe pain.	Before-time pen- sioned on account of the malignant disease. Pains from carrying 6 —7 lbs. of po- tatoes. The pains remain for a day afterwards. His hobby had been sewing before — now impossible.	Paresis of trapezius. Abduction 60°. Re- duced motility in shoulder joint. Nor- mal radialis pulso and sensibility. No trophic disturban- ces.	On 3 occasions, when resting, had the fin- gers become white. This mostly hap- pened to 4th and 5th fingers. In be- tween free from complaints. Able to hold hand in cold water. Not easily cold. X-ray of neck and spine: Minor accumulations on the inferior verte- brae. No metastases. X-ray of shoulder: Slight roughness on the tuberculum majus.
Case 16. Man, aged 45. Machine- tool worker.	Op. of tbc.-lym- phoma on the left side of the neck at age of 7.	No troubles. Noticed shortly after op. that he was unable to lift the arm outwards over the shoulder.	—	Normal.	Paresis of sterno- mastoid and trape- zius. Normal radi- alis pulse and sen- sibility	Suffers from Mh Raynaud, sympa- tectomy on the left side. No gangrene. Admitted to hospi- tal owing to ery- thema exsudativum multiforme.

tense, violent, very irritating, 3 had moderate pains and in 1 case they were mild, *i. e.* like a slight toothache. The pain is located to the shoulder region, radiating from there down along the medial edge of the scapula and out in the arm. 9 patients felt a pain in the whole arm. In 3 cases it extended down to the fingers, one patient having an equal amount of pain in all the fingers, another had pains only in the 4th and 5th fingers, and a third in the 2nd and 3rd fingers and a little in the thumb. The radiating pains in the arm are, moreover, equally manifested on the radial and on the ulnar side. 2 of the 5 remaining cases had pains only from the shoulder to the elbow, 3 just round the shoulder and the scapula.

Paraesthesias: Usually numbness, which sometimes involves the whole arm, but as a rule mostly the fingers. Of 7 patients with paraesthesias 6 felt a numbness in all the fingers, 1 only in the 4th and 5th fingers. In 6 cases the paraesthesias were of the nature of pricking sensations. They were mostly located to the shoulder region and the scapula, occasionally to the palm of the hand and upwards to the face. Sometimes, the paraesthesia was described as a creeping and throbbing sensation in the shoulder and in the arm.

The pains and the paraesthesias have increased in all cases when the arm has been subjected to exertion. Now and then, the weight of the arm itself, when hanging freely, has sufficed to render the pains so severe as to prevent the patient from continuing his or her walk. However, the pains decreased when the arm was resting in the lapels of a coat, against the hip, or on a table. The lifting or carrying of even fairly light objects, such as a hand-bag, a book or a pot-lid, produces pains and numbness. Several patients have found it impossible to keep the arm fixed in an elevated position. They have been incapable of performing needlework, or knitting. It has either been painful or impossible to hold the needle or some similar object owing to the numbness in the fingers. Type-writing, writing by hand, and drawing have frequently caused serious inconvenience which may have remained for some days. The troubles vary according to the type of exertion which the arm is subjected to. Generally they are most severe during the first year, then decreasing somewhat, after which they remain constant. When the arm has been fixed for a while owing to the pains, a stiffness and tenderness in the shoulder joint has

ensued in a few cases. This has most often been more prominent in the mornings and then disappeared when the patient has moved about. But by that time of the day the radiating pains with subsequent numbness in the fingers have appeared instead.

The objective symptoms:

The paresis of the sternomastoid muscle: Fairly soon after the lesion, atrophy of the muscle is noted. It is often complete, probably owing to lesion of both the spinal accessory nerve and the cervical branches. Sometimes a slight torticollis is observed with the chin drawn over to the injured side. The scalene, splenius and other muscles of the neck attend to the function. Therefore, the head can as a rule be moved almost unlimited.

The paresis of the trapezius muscle: Owing to the double innervation the paresis never becomes complete and the atrophy in various sections varies. Paresis in the superior part involves a lowering of the shoulder and the loss of the function of the intermediate part causes the scapula to slip away from the median-line. When the inferior part is paralysed, the angle of the scapula is drawn upwards and medially by the rhomboideus muscles. A typical erroneous position of the scapula occurs with lowering and outward deviation particularly of the superior part. The depression of the external end of the clavicle causes an upward-forward subluxation of the sternal end. According to MONRAD-KROHN, the paresis of the trapezius muscle sometimes gives rise to winging of the scapula. In the more common cases of winging of the scapula, viz., serratus paralysis, the scapula is drawn more closely to the median-line and stands higher than on the healthy side.

The power of the arm is reduced, but no pareses are found, nor atrophy of the small muscles of the hand. The reflexes of the arm are normal. Sensibility was reduced on the radial half of the back of the hand in 1 case, detailed information lacking in 4 cases, being merely reported by letter as subjectively normal. The rest of the patients had normal sensibility, with the exception of a reduction in a minor region below the scar on the neck in a few cases. One patient had, at first, noticed a radial swelling on the back of the hand, but otherwise no trophic disturbances. Oscillography was performed in 2 cases, giving normal deflections. In 6 cases information is lacking regarding the radialis pulse, being otherwise normal.

The Genesis of the Pains.

The pains and the depression of the shoulder are connected with one another. When the arm is given support, they either diminish or disappear. No objective signs of deteriorated circulation have been ascertained. Only one patient suffered from cold fingers, another patient had become more sensitive to cold. A third patient had on a few occasions observed that the fingers grew white when he sat still resting. It soon passed off, however. He had no trouble from holding his hand in cold water.

It seems natural to assume that a tension of the plexus brachialis is the eliciting factor. Judging from the extent of the pains and the numbness, no particular part of the plexus should, as a rule, be especially subjected to this stretching phenomenon.

In a few cases, a secondary periarthrititis and peritendinitis was added, with tenderness and restricted motility in the shoulder joint. The patient has often been capable of distinguishing these troubles as a new kind of pain.

The Effect on the Capacity for Work.

One patient, viz., earlier a farm labourer, states that he is altogether unfit for work. 2 patients are able to perform easy work, but cannot earn their living. In 8 cases, pronounced pains occurred which considerably affected the capacity for work, but did not prevent the patient from earning a livelihood. In 3 cases, the troubles were moderate and have but insignificantly affected the capacity for work. Full capacity for work without any troubles occurred in 2 cases in spite of pronounced pareses. These two patients were not subjected to any pain.

Treatment.

At a fresh injury the nerve has to be sutured. According to the experimental investigations performed by HOLMES and YOUNG (1943), the most suitable time is 2—3 weeks after the lesion. The prospects are good within the next 1—2 months, less good after this time, and bad after 5—6 months.

In the case of an older injury, one is forced to resort to a symptomatic treatment of the pains. Orthopaedic bandages, most often

formed like an eight applied around the arms over the back, have been tested but found very unpleasant to carry and have generally been doffed after a few weeks. Before the X-ray treatment of tuberculous lymphoma the lesions of the spinal accessory nerve were even more common than nowadays. Attempts at correction of the erroneous position of the scapula were made by means of muscle and fascial plastics (ROTSCHILD 1911). In later years the troubles have apparently not been considered sufficiently severe to justify such interventions. Since the pains in the present material have been of the greatest significance with regard to the capacity for work in several instances, the question of relieving plastic interventions has been discussed. WIBERG (1945) has been inclined to perform a fascial plastic intervention between the superior angle of the scapula and the processus spinosi.

At periarthrititis and peritendinitis humeroscapularis, relief is naturally obtained by exercise and X-ray treatment. But the effect is generally very transient. Sometimes a good effect of the treatment has involved a disregard for the suitable time for a nerve suture.

4 of the 16 cases have been subjected to a nerve suture. In 2 cases, the healing was complete, while the two others showed no results from the intervention. In one of these latter cases, the peripheral stump of the spinal accessory nerve could not be found and the nerve was instead sewn together with a branch of the cervical nerves.

Prophylaxis.

A paresis of the trapezius muscle after a surgical intervention on the neck is a serious complication. The important thing is to avoid the spinal accessory nerve as well as the cervical nerves. Most recommends, at *operation of tuberculous lymphomas*, that the spinal accessory nerve should first be looked for and identified. The course of the nerve in the posterior triangle, where it runs just under the skin, can be traced before operation by means of electric stimulation. In the case of tuberculous lymphomas, subjected to caseous changes or melting processes, with extensive adenites, it is no doubt often extremely difficult to identify the nerve fibres and avoid this damage. It is important that the function of the trapezius muscle is tested after the operation, and that the occurrence of pains is subjected to investigation.

When a *biopsy* is to be performed, it is perhaps possible to find a gland in a less risky zone. The intervention should be made on the left side, rather than on the right side of a right-handed person.

Intentional section of the spinal accessory nerve is carried out in cases of *torticollis dystonica* where also the uppermost cervical roots are often severed. In 8 cases where section had been made at the neuro-surgical clinic only of the spinal accessory nerve, 6 cases had been subjected to troubles resembling the type referred to above. 2 patients, not exposed to physical exertion, had had mild troubles, while the remaining ones complained of "rather troublesome" or "severe" pains. The 2 remaining patients had not obtained an erroneous position of the scapula. It may therefore be assumed that the intervention was ineffective. In mild cases of *torticollis*, where the patient is fit for work — particularly physical labour — the risk of pains with increased invalidity after the section of the spinal accessory nerve will no doubt contraindicate a surgical intervention. If also the cervical roots are severed, the paresis of the trapezius becomes complete and more pains are to be expected.

Another intervention where the spinal accessory nerve is severed for therapeutic purposes is that of the *anastomosis operations* in cases of paresis of the facial nerve. As already pointed out by BALLANCE in 1903, the *nervus hypoglossus* can no doubt be used instead. Apart from the absence of the risk of pain, the hypoglossus anastomosis has the advantage of rendering the movements of the tongue invisible when there are facial motions. The tongue paresis is said only to inconvenience the patient during the first weeks.

Summary.

An investigation has been performed on 16 cases of peripheral lesion of the spinal accessory nerve — in 15 cases due to various surgical interventions on the neck, principally lymphoma operations. It has been found that the invalidity following this injury is considerable. It does not derive from the actual paresis of the sternomastoid and trapezius muscles, but from the pains radiating from the shoulder down the arm and to the scapula. These pains are caused by the depression of the shoulder when the trapezius muscle is paralyzed. The mechanism is assumed to consist of a tension in the *plexus brachialis*.

The importance of avoiding nerve lesions at surgical interventions on the neck must be strongly emphasized. This applies both to the spinal accessory nerve and to the spinal nerves from the cervical segments which also innervate the trapezius muscle with motor fibres.

At a fresh injury, the nerve must be sutured. When more than 6 months have passed, the chances of healing are small. Attempts at correction of the erroneous position of the scapula must then be performed by means of orthopaedic bandages or plastic operation.

Zusammenfassung.

Eine Untersuchung von 16 Fällen des peripheren Accessorius-schadens — die 15 nach verschiedenen chirurgischen Eingriffen auf den Hals, besonders Lymphomoperation — zeigt, dass die Invalidität bei diesem Schaden bedeutend ist. Sie wird nicht von der Verlähmung der Sternocleidomastoideus und Trapezius-muskeln in eigentlichem Sinn verursacht, sondern von den Schmerzen, die von der Schulter in den Arm und das Schulterblatt hinab gehen. Die Schmerzen entstehen dadurch, dass die Schulter bei der Verlähmung des Trapezius hinabsinkt. Man nimmt an, dass sie von einer Dehnung des Plexus brachialis verursacht werden.

Deshalb ist es sehr wichtig, dass man Nervenläsionen bei Eingriffen auf den Hals meidet. Dies gilt sowohl Nervus accessorius als Spinalnerven aus den Cervicalsegmenten, die auch M. trapezius motorisch innervieren.

Beim frischen Schaden muss der Nerv suturiert werden. Nach mehr als 6 Monaten werden die Aussichten zur Heilung nur klein. Da muss man versuchen, das Hinabsinken des Schulterblatts mit einem orthopaedischen Bandage oder einer plastischen Operation zu verhindern.

Résumé.

L'auteur a étudié 16 cas de lésion périphérique du nerf spinal, dont 15 causés par différentes interventions chirurgicales dans la gorge, notamment par des opérations de lymphadénome. Il a trouvé que cette lésion cause une invalidité grave, résultant non de la parésie du sterno-cléido-mastoidien ou du trapèze mais des douleurs irradiant de l'épaule dans le bras et vers l'omoplate.

Ces douleurs sont causées par l'affaissement de l'épaule, amené par la paralysie du trapèze. Il est supposé que le mécanisme en est une tension du plexus brachial.

Il faut insister tout particulièrement sur l'importance d'éviter les lésions de nerf à l'occasion des interventions chirurgicales dans la gorge. Cela s'applique non seulement au nerf spinal mais aussi aux branches des nerfs moteurs cervicaux, qui innervent eux aussi le trapèze.

Si la lésion est fraîche, on suture le nerf. Si plus de six mois sont passés, la possibilité de guérison est minime. Dans ce cas-là il faut essayer de remettre l'omoplate dans sa situation normale par moyen de bandages orthopédiques ou bien par une opération plastique.

Literature.

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Malignant Goiter.¹

By

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My oldest reminiscences of the term "malignant goiter" date from my earliest days of service at pathological and surgical hospital departments. They are concerned, on the one hand, with cases where, for example, a histologically benignant adenoma was considered to have given rise to a metastasis in a vertebra, on the other hand, with thyroid affections where the result of the pathologico-anatomical examination had to be confined to the diagnosis "malignant goiter" (the histological pictures were such that they could not be considered typical either of cancer or sarcoma). My subsequent experience on the basis of my own material has confirmed these and closely related peculiarities; in particular, it has shown the difficulty, in many cases, of finding a reasonably good correspondence between morphology and clinical observations in cases of what is usually by the pathologist designated as malignant goiter. In this material — which down to the end of the year 1945 comprises nearly 4,500 operated cases of goiter —, there are 42 cases, or nearly 1 %, of such a character that they were considered, or seriously suspected, to be malignant either by the surgeon or the pathologist, or both.²

A survey of the principal details in the said cases of goiter therefore seems to be warranted, especially with regard to the prevalent view that cancer of the thyroid is a rather hopeless

¹ Read before the Swedish Surgical Society on the 22nd February, 1946.

² The microscopical examination of the operation preparations was made by experienced pathologists, namely: Drs. WAHLGREN and RINGERTZ (the majority of cases), WILTON, H. HANSSON, Å. LINDGREN as well as by Professors HENSCHEN, REUTERWALL, SUNDBERG and BERGSTRAND.

disease, and to the divergence of opinion with respect to its proper treatment. This has also influenced opinion regarding the indications for operation in cases of goiter clinically viewed as benign adenomas: with special reference to views such as those expressed by CRILE — who believes that carcinoma of the thyroid in 95 per cent. of the cases develops in fetal adenomas —, or by LAHEY — who states that 90 per cent. of the malignant thyroid cases had previously shown adenomas in the thyroid gland — the indications for the operation of solitary adenomas have been considered in some quarters to be very wide, and the microscopical observation of cancer in such cases has been considered by many surgeons to involve the imperative necessity of immediate total thyroidectomy.

The figures given in the literature for the frequency of malignant goiter, broadly speaking, do not show much variation.¹ CRILE² estimates 139 cases, or 2.2 per cent., in 6,427 strumectomies, CLUTE³ 187 cases in 6,535 (= 2.86 %). RIENHOFF⁴ states that the frequency lies between 0.5 and 2 per cent. in large clinical materials.

I do not intend, in this connection, to enter into a detailed discussion of the clinical symptomatology and diagnostics. That the diagnosis in the whole disease group, from beginning to end, was beset with great difficulties is, however, evident from the following facts: Out of my cases with pathologico-anatomically ascertained (in 4 cases, suspected) malignant struma,⁵

18 before the operation had been regarded as benignant;

4 during the operation, owing to adhesion to the surrounding tissues, or the like, and the actual operation findings, had aroused some suspicion of malignity, and only

17, on clinical examination before the operation, had been diagnosed as malignant.

These figures in themselves, as already indicated, point to considerable difficulties in the clinical diagnosis of goiters which,

¹ A number of figures on the subject are given in HERTZ' large work on "Goitre and allied diseases", 1943, p. 458.

² Endocrinology 9, 1925, 307.

³ New Engl. Journ. Med. 205, 1931, 1083 (LAHEY's material).

⁴ DEAN LEWIS: Practice of Surg. VI, 1938, 197.

⁵ I have excluded three cases (Nos. 7, 16 a, and 26) with the clinical type of diffuse exophthalmic goiter, which the pathologist, with some degree of certainty, considered to be cases of tumour. These three patients lived, free from relapses, 6—20 years after the operation; case 7 greatly puzzled the pathologist ("a certain cellular atypia"). — The figures in brackets in this paper refer to the numbers in my own records of the individual goiter cases. The corresponding hospital numbers are given in a separate list, appended to this paper.

on pathologico-anatomical grounds, had been designated as malignant. In about half the number of cases, malignity had not been suspected at all before operation. And the difficulty of reliably judging the biological character of the cases is shown still more strikingly when we learn that just as many — though not throughout precisely the same 18 cases —, despite a mostly non-radical operation (see below), had remained free from recurrences for 5—28 years after the surgical treatment (and 11 cases 9—28 years after the operation). Evidently, the *clinical* diagnosis in this tumour group leaves much to be desired. How matters stand, in corresponding respects, with the *pathologico-anatomical* diagnosis (p. a. d.) is shown — in a very surprising way —, by a careful examination of the subsequent course of the cases.

Follow-up examinations in fact indicate that

1) out of 14 patients subjected to *operative treatment* which might possibly have been regarded as *radical* (extirpation of a whole lobe or, in cases 1 and 37, enucleation of a solitary adenoma) one patient (5), a woman aged 58 years in 1925, suffering, according to the p. a. d., from cancer, is still alive 21 years after total extirpation of the one thyroid lobe (the suspicion of metastases in the lungs, and possibly in both capita femoris, on the ground of the X-ray examination one month after the operation, has certainly been unjustified). It should further be noted in regard to these cases that (inclusive of the said female patient)

4 had remained *free from recurrences* for 9—28 years (1, 5, 8, 16),

3 had remained *free from recurrences* for 5—7 years (6, 14, 28),

2 are living *free from recurrences* quite 2 years after op. (37, 38¹),

1 had a *recurrence* after 8 years and was reoperated about half a year ago with primarily satisfactory result (22),

4 died of a recurrence after 3½ years (27) or 1—2½ months (4, 12, 21).

It ought to be added that postoperative X-ray-treatment was given to two of the cases without recurrence (16, 18) and — after the reoperation — to one of the cases with recurrence (22).

2) As regards the group of 24 patients who presumably had *not been radically operated* — merely unilateral or bilateral resection had been performed — the following facts should be noted:

¹ Fully reliable information about this latter case has not been available.

1 patient (No. 2) died in connection with the operation, *Freedom* from recurrence for 9—20 years was recorded in 7 cases (7, 10, 11, 16, 17, 20, 23),

Freedom from recurrence for 6—7 years was recorded in 3 cases (3, 24, 26),

Freedom from recurrence for $\frac{2}{12}$ —3 years was recorded in 7 cases (31, 32, 33, 36, 41, 42, 46),

Recurrence with a fatal issue occurred in one case after 7 years (25), in 2 cases after 2—3 years (34, 44), in 2 cases after 4—5 months (13, 40). In regard to one strumectomized case, subsequent information is not available (19).

In five of the recurrence-free cases (31, 32, 33, 36, 46) and in one of the relapsing (34), postoperative X-ray treatment had been given.

3) There remain 4 cases which had either not been operated at all (9) or which had been subjected only to tracheotomy (18) or biopsy (29, 43); all of them died after at most nine months.

Any attempt to treat these figures statistically is, of course, out of the question, especially as subsequent information is lacking in one of the 42 cases. The reported facts, however, call for certain comments. On the one hand, it is noteworthy that in two cases (22, 25) relapses had occurred so late as after 7—8 years. On the other hand, it is of interest to note that, despite the conservative treatment, no less than 11 patients had remained free from recurrences for 9—28 years after the operation. On the basis of the pathologico-anatomical diagnosis, this could scarcely have been expected. It may, of course, be questioned whether the operation in any of the cases was what, in the usual clinical sense (as regards cancer), would have been designated as "radical". But, that such a large percentage both of the possibly radically operated cases and of those where the operative treatment was presumably non-radical should have shown a definitive freedom from recurrences, is so remarkable that — if all these cases, in a biological sense, had really been malignant —, it must be inferred that the technical "radicalness" of the operation was rather meaningless. And this, of course, is utterly at variance with all experience of the treatment of cancer in other organs.

In considering whether we can give any reasonable explanation of the rather slight difference in efficacy — apparently evidenced by these observations —, between "radical" and non-radical strumectomy in cases indicated by the histological examination

to be malignant goiter, we are confronted firstly with the question whether it is possible, from a clinical and morphological point of view, to show distinct and typical characteristics of the different groups of goiter cases in question.

That cancer, like sarcoma, may vary in malignancy from case to case is well known in regard to the thyroid gland and also other organs. PEMBERTON (Mayo clinic; Surg. Gyn. Obst. 69, 1939, 417), PORTMANN (CRILE's material; Surg. Gyn. Obst. 70, 1940, 185) as well as WATSON and POOL (Memorial Hosp., New York; Surg. Gyn. Obst. 70, 1940, 1037) have shown this on the basis of large materials, and have divided malignant thyroid tumours into certain groups with different pathologico-anatomical characteristics. I refrain from making a similar grouping of my material. Instead, I find it very reasonable clinically to distinguish those cases where the patient for a considerable length of time before operation had had an entirely or nearly symptom-free goiter and not until a comparatively late stage had noticed a more rapid growth or any aggravated symptoms at all, from cases with a short, or at any rate, continuous and uniform anamnesis. This so much the more, as it is frequently stated in the literature that malignant goiter, in the great majority of cases, is preceded by a long pre-existing benign goiter. According to RIENHOFF, this occurs in 80—90 per cent. of the cases. In LAHEY's material, as already mentioned, 90 per cent. of the malignant cases of thyroid affection are reported to have previously shown adenomas in the gland.

An attempt at a division on these lines, as regards my own material, yields the following results:

(1) 16 of the patients stated, on admission to the hospital, that they had noticed *goiter for many years*, but that they had observed a *rapid growth* thereof, or otherwise aggravated symptoms, only *during a relatively short period* — as a rule a few weeks or months.¹

As regards some of these cases, a few details deserve brief mention:

38: P. a. d. malignant tumour, partly sarcomlike.

10: P. a. d. cancer; also pictures of richly cellular alveolar sarcoma.

19: One of the adenomata had the character of an embryonal micro-

¹ Those cases of apparent diffuse exophthalmic goiter where the microscopic picture gives reason to consider the diagnosis: "tumour" have not been included here.

follicular adenoma. X-ray examination one month after operation revealed a great destruction of C III.

- 44: P. a. d., in the operation specimen, nodular goiter, mostly with the embryonal type of adenoma. $3\frac{1}{2}$ years later a grotesquely large recurrence (Fig. 1), shortly afterwards followed by death. P. a. d. adeno-carcinoma, as a rule without colloid, but with richly colloidal metastases in the lungs. The second examining pathologist considered, on subsequent inspection, that also the sections from the first operation specimen unmistakeably showed cancer.

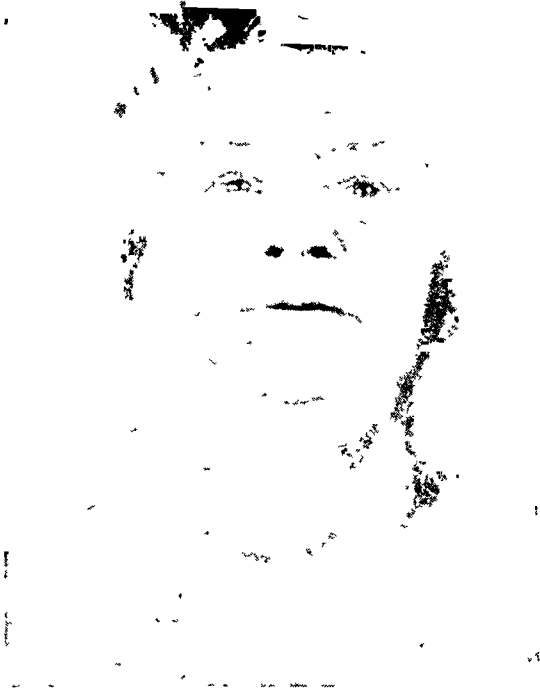


Fig. 1.

- 31: Cancer with alveolar structure, in places with an appearance resembling flat epithelium, but without cornification. 14 months later the patient died at a hospital of cancer pancreatis, with metastases in the liver and brain.
- 22: P. a. d. after the first operation, cancer. Operation for recurrence 8 years later (struma aberrans on the same side of the neck as the primary goiter); p. a. d. — by another pathologist —, suspected, but not certain, cancer.
- 36: P. a. d. highly differentiated adeno-carcinoma; in one place an epithelial cord was observed to have invaded a capsule vein.

Further particulars of interest in regard to these patients are the following:

3 died of their goiter — a few months to 3 and, respectively, 7 years after operation (21, 44, 25);

1 had a recurrence after 8 years, but is living in good condition about half a year after the re-operation (22);

1 is living after 2 years without recurrence (42);

1 died of another disease (pancreatic cancer with metastases to the brain and liver) after 14 months without a recurrence of goiter (31);

2 are living symptom-free after $2\frac{1}{2}$ —3 years (36, 37);

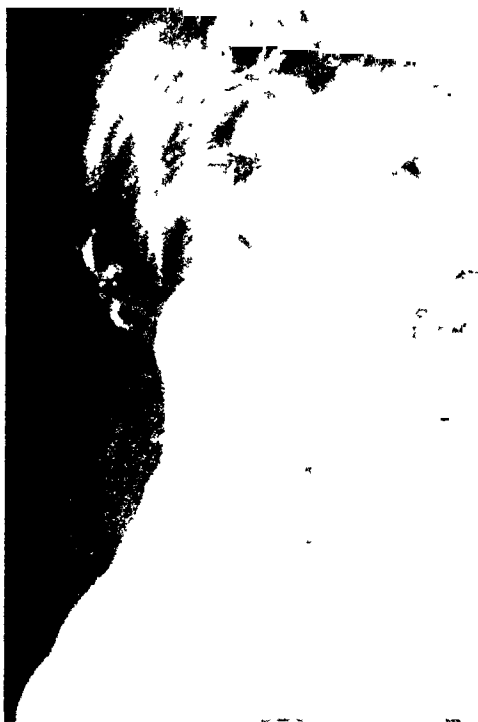


Fig. 2.

2 lived free from recurrence for 7 years (3, 24; the first-mentioned afterwards died of cerebral hemorrhage); 1 died after $3\frac{1}{2}$ years, of a recurrence (27);

3 are living in good health after 10—28 years (1, 16, 20);

1 of them could not be traced (19);

1 died in immediate connection with the operation (2).

It thus appears that 5 of these 15 patients who had survived after a not very radical strumectomy had remained — in all probability, definitely —, cured from a disease which, according to the pathologico-anatomical diagnosis, was malignant struma. And in 4 out of the 5 cases which have hitherto shown a relapse, it occurred after a lengthy period (3—8 years); merely in one of

these cases at an early stage (after a few months). The experiences thus seem to correspond rather badly with the view represented by RIENHOFF, CRILE and others, that adenoma of the thyroid is usually a prelude of cancer.

(2) A partly similar final conclusion may be drawn from a survey of the disease course in the 19 cases, in this material, with a *short*, or at any rate continuous and uniform, goiter *anamnesis* (in two cases an anamnesis of 3 years, in three of $1\frac{1}{2}$ —2 years, in three of 1 year, in the remainder an anamnesis of 3 weeks—8 months). The clinical symptom picture in some of these cases is rather marked and, *per se*, gives reason for another diagnosis than benign goiter. The microscopic findings moreover sometimes revealed remarkable details.

Certain of these details are worth noting.

- 13: Clinical diagnosis before operation, acute strumitis, during operation suspicion of malignancy. P. a. d. cancer. Death 4 months after resectio lob. amb. At the autopsy, metastases in the liver.
- 29: Since a year change in the voice, difficulty in swallowing, emaciation. Biopsy. P. a. d. cancer, in places with sarcomlike pictures; in one section cancerous matter was observed in a veinlike lumen.
- 41: Enucleation-resection of a solitary adenoma with a fatty cut surface. P. a. d. cancer; a certain tendency to infiltration into the capsule area. Two years later perfectly healthy.
- 16: Clinical diagnosis, lymphosarcoma colli(?). The extirpated tumour partly melanotic in colour. P. a. d. highly differentiated adenocarcinoma gland. thy. After 10 years free from recurrence.
- 32: Respiratory difficulties since a year. P. a. d. highly differentiated adenocarcinoma; in places, glandular epithelial proliferations grow into and through the thick capsule, in one place into a vessel. Roentgen treatment. 3 years later free from recurrence.
- 5: During the last five months pains and change in the voice. S. R. 32 mm. The goiter firmly fixed to the trachea. P. a. d. cancer. Death after a month.
- 6: Extirpation of tumour suspected to be cancer. P. a. d. sarcoma. 7 years later free from recurrence.
- 12: Extirpation of tumour with very marked peristrumitis. P. a. d. sarcoma. Recurrence after $1\frac{1}{2}$ month; death.
- 28: Tenacious peristrumitis. P. a. d. reticular cell sarcoma. After 5 years free from recurrence.
- 14: 64-year-old woman with three years anamnesis and S. R. = 83 mm. Extirpation. P. a. d. struma maligna. After 6 years free from recurrence.
- 46: Woman aged 51 years. 7 years ago, difficulty in swallowing; X-ray treatment. Two years ago noticed goiter, became short of breath and emaciated. S. R. = 5 mm. Resectio lob. unius. P. a. d.

struma maligna; a certain resemblance to very richly cellular, microfollicular adenoma of embryonal type. Postoperative X-ray treatment (operated upon only two months ago).

33 and 4: P. a. d. planoepithelial cancer. After 2 years the first-mentioned patient was free from recurrence, the other died after a month.

34: Man aged 66 years. One year's anamnesis. S. R. = 8 mm. Resectio lob. unius (the other lobe free). P. a. d. Langhans' usurious goiter; in a few places the epithelium invades capillary or veinlike lumina. Two years later recurrence. S. R. = 42 mm. No operation. Death. P. a. d. cancer with metastases in the lymph-glands of the neck and mediastinum and in the lungs; follicles were found here and there in the thyroid tumour, but not in the lung metastases.

17 and 23: Clinical diagnosis before operation strumitis chron. (RIEDEL or HASHIMOTO) and multiple adenomata respectively. Resectio lob. amb. P. a. d. in the first-mentioned case by one pathologist, cancer; by another, strumitis chron. RIEDEL; in the second case cancer, with pictures resembling strumitis chron. RIEDEL. After 9 years both patients were free from recurrences.

The final effect of the treatment in this group of cases is indicated — so far as it is known —, by the following figures:

6 died of their goiter — in 4 cases after 1 to 6 months (4, 12, 13 40); 2 cases were not operated (29, 43);

1 had a recurrence and died after 2 years (34); 1 died of a recurrence after 3 years (44);

3 are living in good health after 2, 3 and 3 years, respectively (41, 32, 33);

2, after 5 and 6 years, respectively, are free from recurrences (28, 14);

1 died after 7 years, without having had a recurrence (6);

4, after 9—20 years, have remained free from recurrences (5, 8, 16, 23);

1 was operated upon less than a year ago, has not had a recurrence, and is consequently without interest in this connection (46).

Also in this group of patients, 19 cases, 5 have remained — presumably definitely —, cured from a disease which, according to the pathologico-anatomical diagnosis, was malignant goiter, by a scarcely radical operation. Where relapses occurred — in 6 cases — they appeared, broadly speaking, at a rather early stage: in 4 cases within six months, in one after 2 years, and in another after 3 years. (It is only in this latter respect that these cases differ from those in the first group.)

The clinical course in these two, approximately equally large, groups of patients, has thus been fairly similar: about *one-third to one-fourth of the cases* — both those who, at the first consultation, mentioned that they had long noticed goiter symptoms, but only latterly had suffered serious discomfort from them, and those who

declared that they had had thyroid symptoms merely for a relatively short period —, *despite the pathologico-anatomical diagnosis and the more or less non-radical operative procedure, had scarcely shown the disease course characteristic of a malignant new-growth.* Plainly, it is difficult, in many of the cases, to bring the pathologico-anatomical diagnosis into line with the supposition of a malignant thyroid affection.

From the disease histories it is moreover evident that the occurrence of certain peculiar or distinctive symptoms — such as change of voice, respiratory troubles, pains, local sensitiveness to pressure, etc. — are details that deserve special attention in diagnosis; likewise — according to experience in many cases —, a high sedimentation rate. In 2 out of 4 cases of adenomatous goiter, cancerous cells in capillary or vein-like lumina had been observed in patients who died within barely six months (29) and, respectively, two years (34); the two others showed three years' freedom from recurrences. (GRAHAM's¹ statement to the effect that such invasions are significant of malignancy in fetal adenomata of the thyroid can thus scarcely be considered to have been confirmed by my experience. CLUTE reproduces a report from SHIELDS WARREN according to which blood vessel invasion, after the investigation of 1,114 specimens from thyroid adenomata, had been found in thirty-four patients, two of whom died later of undoubted metastases from thyroid cancer.)

That, in the microscopic examination of goiters, the diagnosis presents extreme difficulties, even for an experienced pathologist, is quite evident. This is borne out by several statements in the literature, as exemplified by the following citations. RIENHOFF mentions that a goiter in a young girl, after the examination of the specimen, was diagnosed by three very experienced pathologists in the United States, respectively, as cancer, thyroiditis and diffuse exophthalmic goiter. LAHEY states that "the only test on malignancy in many thyroid tumours is the course of their later history". WATSON and POOL make in their above-mentioned article the following statement: "Cancer of the thyroid is an exceptional disease in that it fails to follow the general tumour behaviour laws, and its reaction to surgical and radiation therapy is quite unique. Even though a wealth of operative material has been studied histologically, there is no tumour in the head and neck group which seems to present more diagnostic problems for

¹ Cited by CLUTE, *op. cit.* (p. 6 in the reprint).

Table 1.

No.	Age years	Sex	S. R.	Clin. diagn.	Op.	Weight of prep.	P. a. d.	Postop. rtn.	Recurrences and deaths	Notes
4	49	♀	84	Ca?	Extirp. of one lobe	15 gm	Plano epithel. cancer	—	Died after 1 month	
12	64	♀	53	Ca?	Extirp. of one lobe (the other free)	—	Str. mal.	+	Died after 1½ monhts	P. M. Lung metast.
13	80	♀	50	Strumit. chron. (ca. susp. at oper.)	Res. lob. amb.	26 gm	Ca	—	Died after 5 monhts	P. M. lung and liver metast.
21	51	♀	38	Ca?	Extirp. of one lobe	94 gm	Ca	—	Died after 2½ months	
22	58	♂	8	Benign ade- noma (ca. susp. at oper.)	Extirp. of one lobe	44 gm	Ca	+	Recurr. after 8 years in same lobe	Recurr. P. a. d. susp. Ca. Post- op. rtn.
25	56	♀	—	Ca?	Res. lob. amb.	165 gm	Probably Ca	—	Died after 7 years	Large recurr. to right on neck (fig. 2)
27	70	♀	14	Benign adeno- mat. goiter	Ext. lob. unius	205 gm	Ca	+	Died after 3½ years	
34	66	♂	8	Benign adeno- mat. goiter	Res. lob. unius	145 gm	Ca	+	Died of recurr. after 2¼ years	Besides local recurr., lung and mediast. metastases.
40	60	♀	—	Ca?	Res. lob. amb.	70 gm	Ca	—	Died after 2 months	Lung metast.
44	66	♀	16	Benign adeno- mat. goiter	Res. lob. amb.	197 gm	Ca ¹	—	Died of recurr. 3¼ years after op. (SR then = 55) P. a. d. Ca	P. M.: also lung metast.

¹ The pathologist who examined the recurrence preparation and diagnosed Ca considered — unlike the pathologist who examined the first extirpated goiter and who diagnosed adenoma of embryonal type —, that undoubted Ca had existed also in the previously removed goiter.

the tumour pathologist." The pathologico-anatomical diagnosis alone, on the basis of an ordinary microscopic examination, does not *per se* warrant a definitive judgment as to whether a goiter, in a biological sense, is malignant or not. Consequently, I consider it unjustifiable to insist on the removal of an adenomatous goiter merely on the ground of a very wide indication: in short, one should not resort to a radical procedure solely because of the risk that such a thyroid lesion may show a particularly marked tendency to malignant degeneration. Obviously, however, where a surgical operation is clearly indicated and can be carried out without too big a risk, it should be performed even in cases of *presumed* malignancy, and be followed up by X-ray treatment.

In conclusion, it may be desirable to touch on the question whether the number of recurrences in my cases might have been reduced if a fundamentally different operative procedure had been adopted. The follow-up investigations show that recurrences or metastases manifested themselves after longer or shorter intervals in 10, and led to death in 9 strumectomized cases. The following particulars regarding them seem to be of interest (see table 1).

It is seen from this table that, out of these ten cases — 2 men and 8 women, all aged from 50 to 80 years —, one man (No. 22) was re-operated for a recurrence 8 years after the primary operation and has survived and now (in Febr. 1946, quite six months after the re-operation under X-ray treatment) he is in good health, whereas nine died of their malignant struma — five after 1 to 5 months, one after quite 2 years, two after quite 3 years, and one after 7 years. The sedimentation rate (S. R.) before the primary operation was very high in those patients who died at an early date and, as regards all of them but one, the possibility of malignancy had been reckoned with, before or during the operation. Nevertheless, the operative treatment was confined to a total extirpation of one lobe, or to resection of both lobes. Those who died after a longer time, as well as the re-operated, still living man, had been subjected either to unilateral lobe extirpation or to bilateral resection. I consider it scarcely probable that a more radical — and far more hazardous — operation would have entailed better results for those who died at an early date. As regards the four patients who survived for a considerable length of time (Nos. 25, 27, 34 and 44), and who had been subjected merely to the above indicated conservative operations, such a possibility cannot be completely ruled out. My conservative procedure in

these cases seemed to be warranted by the clinical picture, with good general condition and large adenomatous goiters, — it is significant that the microscopic findings in one case (No. 44) were so difficult to judge that the pathologist who first examined the extirpated goiter considered that it was not a malignant growth.

In the text, the figures in brackets correspond to the numbers of the records in St. Görans Hospital (SG) and Serafimerlasarettet (SL), according to the following indications:

1 = 1043/1913, I SL.	23 = 2096/1937, SG.
2 = 1034/1918, II SL.	24 = 677/1939, SG.
3 = 1684/1924, Sofiahemmet.	25 = 1782/1932 and 743/1939, SG.
4 = 783/1924, I SL.	26 = 138/1940, SG.
5 = 1051/1925, I SL.	27 = 925/1940, SG.
6 = 1037/1926, I SL.	28 = 2032/1941, SG.
7 = 1074/1926, I SL.	29 = 638, 1224/1942, SG.
8 = 1183/1926, I SL.	31 = 2775/1942, SG.
9 = 530/1927, SL.	32 = 289/1943, SG.
10 = 181/1928, SL.	33 = 1303/1943, SG.
11 = 1794/1928, SL.	34 = 1381, 2176/1943, SG.
12 = 270/1929, SL.	36 = 1903/1943, SG.
13 = 526/1933, SG.	37 = 2391 and 3016/1943, SG.
14 = 1154/1933, SG.	38 = 2724/1943, SG.
15 = 92/1936, SG.	40 = 2069/1944, SG.
16 = 2690/1934, SG.	41 = 2594/1944, SG.
17 = 35/1935, SG.	42 = 2678/1944, SG.
18 = 159/1935, SG.	43 = 2824/1944, SG.
19 = 1931/1935, SG.	44 = 1759/1942 and 1125/1945, SG.
20 = 1889/1936, SG.	46 = 3694/1945, SG.
21 = 767/1937, SG.	
22 = 1946/1937, SG.	

Summary.

The frequency of malignant goiters in the present material is nearly 1 per cent (42 cases out of a total of 4,500). 4 patients were either non operated at all or were subjected only to biopsy or tracheotomy. 18 cases were regarded before the operation as benign. At follow-up investigation of the strumectomized patients one of them could not be traced (one died in connection with the operation). The operative treatment may in 14 cases, at the utmost, be termed "radical" (extirpation of a whole lobe, or enucleation of an adenoma); four of them remained free from

recurrence for periods ranging from 9 to 28 years. In 24 cases the operation was confined to unilateral or bilateral resection, thus to a certainly non-radical operation; seven of them after 9—30 years were still free from recurrence. Neither of the two groups includes any case where a relapse occurred later than after 7 (one case) or 8 years (one case). All this is distinctly at variance with experience regarding the effect of surgical cancer-treatment in other organs — 16 patients had been aware of the disease for many years, but had not noticed the growth of their goiter or other aggravations until shortly before the operation, 19 patients had suffered from goiter merely for a relatively brief period. In spite of the path.-anatomical diagnosis malignant goiter 5 of the 15 surviving patients in the first group, and at least 4, probably 5, out of the 19 patients in the second group (being one-third to one-fourth of the cases) remained — apparently definitely — free from recurrence. And were relapses occurred, they manifested themselves as a rule at a late stage in the first group, earlier in the second. On the whole it makes it difficult, as regards many of the cases, to bring the pathol.-anatomical diagnosis in line with the clinical facts. Thyroid adenomata do not seem to be a common prelude of thyroid cancer (cfr. RIENHOFF, CRILE and others). — As to the treatment of malignant goiter, the following general points seem to be called for.

1) Adenomatous goiters, suspected of malignancy, in persons over 50 years of age, with a short anamnesis, change in voice, shortness of breath and a very high sedimentation rate, have a particularly bad prognosis. In view of the great drawbacks and hazards involved in a total thyroidectomy, this procedure is advisable only in very rare cases; its possibilities (should the patient survive the operation) of effecting a definite cure seem to be very limited.

2) Both for the clinician and the pathologist it may be broadly stated, that the diagnostic determination of malignancy (in a biological sense) or non-malignancy evidently presents such difficulties, that definite rules for surgical treatment of these goiters cannot be laid down.

3) If the pathol.-anatomical diagnosis indicates malignancy, the op. should be followed up by X-ray treatment. Possibly, this treatment may be of value also in non-operable cases.

Zusammenfassung.

Magligner Kropf kommt im vorliegenden Material in beinahe 1 % vor (42 Fälle auf insgesamt 4,500). 4 Pat. waren entweder gar nicht operiert worden oder nur Gegenstand einer Probe-excision oder Trakeotomie gewesen. Bei Nachuntersuchung der Strumektomierten war es betreffs eines Falles unmöglich, Auskunft zu erhalten (ein Pat. starb kurz nach der Op.). Der Eingriff ist in höchstens 14 Fällen als radikal zu bezeichnen (Exstirpation eines ganzen Lobes oder Enukleation eines Adenoms); von ihnen waren 4 rezidivenfrei 9—28 Jahre. Auf 24 Pat. wurde ein- oder doppelseitige Resektion ausgeführt, d. h. eine sicher nicht-radikale Op.; von ihnen waren 7 rezidivenfrei 9—20 Jahre. Für keine dieser beiden Gruppen gab es Fälle wo Rezidiv später als nach 7 (ein Fall) oder 8 Jahren (ein Fall) auftrat. Alles dies streitet scharf gegen die Erfahrung über chirurgische Behandlungsergebnisse von Cancer in anderen Organen. — 16 Pat. hatten vor der Op. Kropf während vieler Jahre, Vergrösserung desselben oder ähnliche Symptome nur kurze Zeit bemerkt, 19 Pat. hatten Kropfsymptome nur ziemlich kurze Zeit bemerkt. Trotz path.-anat. Diagnose Maglignität blieben nach nicht besonders radikaler Op. 5 von den 15 der früheren Gruppe zühörenden Pat. und mindestens 4 (wahrscheinlich 5) von den 19 der späteren Gruppe — d. h. $\frac{1}{3}$ — $\frac{1}{4}$ der Fälle — vermutlich definitiv rezidivenfrei. Und, wo Rezidiv auftrat, geschah das in der ersten Gruppe in der Regel spät, in der zweiten früh. — Im grossen ganzen ist es für viele Fälle schwierig, die path.-antomische Diagnose Malignität in Übereinstimmung mit dem klinischen Befunde zu bringen. Schilddrüsenadenome scheinen nicht ein gewöhnliches Vorstadium eines Carzinoms zu sein (vgl. RIENHOFF, CRILE u. a.). — Über die Behandlung von malignen Kröpfen ist übrigens folgendes zu sagen.

1) Nodöse, vor Malignität verdächtige Kröpfe bei über 50 Jahre alten Individuen mit kurzer Krankengeschichte, gestörter Stimme und Atmung und stark erhöhten Senkungsreaktion haben die schlimmste Prognose. Angesichts der grossen Gefahren und Unbehagen einer totalen Thyreoidektomie soll dieser Eingriff nur in sehr seltenen Ausnahmefällen in Frage kommen; ihre Möglichkeiten, definitive Heilung dem Pat. — wenn er überlebt — zu bringen, dürften sehr begrenzt sein.

2) Im grossen ganzen gilt für sowohl den Kliniker als den Pathologen, dass die diagnostische Feststellung, dass ein in biologischer Beziehung maligner Kropf vorliegt, so grosse Schwierigkeiten bietet und so unsicher ist, dass bestimmte Richtlinien für die chirurgische Behandlung nicht anzugeben sind.

3) Deutet die path.-anat. Untersuchung auf Maglnitât, soll röntgenologische Behandlung nach der Op. eingeleitet werden. Möglicherweise ist Röntgenbehandlung auch wertvoll in inoperablen Fällen.

Résumé.

Dans le matériel en question la proportion des goîtres malins atteint presque 1 % (42 cas sur un total de 4,500). Quatre des malades ne furent pas opérés du tout, ou seulement soumis à une biopsie ou à une trachéotomie. Dix-huit des cas avaient été considérés comme bénins avant l'opération. Lors de l'examen ultérieur de contrôle des sujets qui avaient subi la strumectomie, l'un ne put être retrouvé (un autre était mort des suites de l'opération). L'intervention ne peut être qualifiée de radicale que chez 14 malades au maximum (extirpation de tout un lobe, ou énucléation d'un adénome); de ceux-ci, 4 étaient sans récédive de 9 à 28 ans après. Chez 24 malades on pratiqua une résection uni- ou bilatérale, donc une opération qui n'était certainement pas radicale; sept d'entre eux étaient sans récédive de 9 à 20 ans plus tard. Aucun de ces deux groupes ne présente de cas où la récédive soit apparue après plus de 7 ans (un cas) ou de 8 ans (un cas). Ces résultats viennent nettement à l'encontre de toutes les expériences qu'on fait avec le traitement chirurgical du cancer d'autres organes. — Seize malades s'étaient aperçus de leur goître de longues années avant l'opération, mais n'avaient constaté son accroissement, ou des symptômes similaires, que depuis peu seulement. Dix-neuf sujets n'avaient présenté de symptômes attribuables au goître que depuis un temps relativement court. Bien qu'il se soit agi de goîtres malins, diagnostiqués tels par l'examen anatomo-pathologique, et que l'opération n'ait pas été particulièrement radicale, 5 des 15 survivants du premier groupe, et au moins 4, probablement même 5 des 19 du second, c'est-à-dire 1/3 à 1/4 des cas, sont, à ce qu'on peut admettre, définitivement sans récédive. De plus, là où une récédive est survenue, ce fut, en règle générale,

tardivement dans le premier groupe, et précocement dans le second. A tout prendre il est difficile, dans beaucoup de cas, de mettre le diagnostic anatomo-pathologique de malignité en accord avec les constatations cliniques. L'adénome thyroïdien ne semble pas être un stade préliminaire habituel du cancer (v. BIENHOFF, CRILE et autres). — En ce qui concerne le traitement des goîtres malins il faut, par ailleurs, relever les points suivants:

1) Les goîtres nodulaires, évoquant le soupçon de cancer, chez des individus de plus de 50 ans, avec une anamnèse courte et, spécialement, une atteinte de la voix et de la respiration, ainsi qu'avec une vitesse de sédimentation fortement augmentée, sont les plus mauvais du point de vue du pronostic. Vu les grands inconvénients et risques d'une thyroïdectomie totale, cette intervention ne doit être tentée que dans de très rares cas d'exception; à supposer que le malade y survive, ses possibilités quant à une guérison définitive sont sans doute très limitées.

2) Dans l'ensemble, et cela vaut aussi bien pour le clinicien que pour l'anatomo-pathologiste, le diagnostic d'un goître malin au sens biologique offre de si grandes difficultés et est si incertain qu'on ne saurait donner de directives péremptoires pour le traitement chirurgical.

3) Lorsque l'examen anatomo-pathologique indique de la malignité, l'opération doit être suivie d'un traitement par les Rayons Roentgen. Peut-être ceux-ci ont-ils aussi une certaine valeur dans les cas inopérables.

From Ullevål Hospital, Dept. III (Surgery).
(Chief: CARL SEMB, M. D.)

Ulcus Simplex Jejuni.

By

ANDREAS HÖYER.

By ulcer simplex in the small intestine, we mean an ulcer localized to the jejunum or ileum, which in appearance is just like a stomach or duodenal ulcer, and which is not due to a tumor, lues, tuberculosis, acute inflammations, traumata or any other intestinal affection. The ulcers which develop above a stenosis ("Dehnungsgeschwüre") are not classified as ulcer simplex, nor are ulcers and perforations caused by foreign bodies, the post-operative jejunal ulcer, or ulcers in Meckel's diverticulum.

The first to describe this ulcer was CRUVEILHIER in 1830. He claims the existence of an ulcer simplex in the small intestine which is completely analogous to stomach ulcers. M. GRASSMANN (1925) takes up the question of ulcer simplex in the small intestine in great detail in an extensive investigation. He defines it as an isolated loss of substance in the mucous membrane and deeper layers of the small intestine, with sharp limitations and without pronounced inflammatory alterations of the surroundings, and of an unknown etiology. He reviews all of the hitherto reported cases in the literature, 51 in all, 20 of which he discards as not fulfilling the definition of an ulcer simplex.

Since then a number of extensive and shorter publications have appeared on this subject, most of them casuistic, reporting a single case. In Norway one case was described by WISLÖFF in 1925 and the condition is discussed in detail by SCHILLING in 1928 in conclusion to a case of ulcer simplex ilei which he operated personally.

MORRIN (1931) made a compilation of 82 cases of ulcer simplex in the small intestine. An idea of how rare this condi-

tion is may be obtained from the fact that up to 1936 only 10 cases had been treated at the Mayo Clinic. Up to 1941 a little over 100 cases have been described in the literature. Since then no cases seem to have been reported.

Ulcus simplex jejuni and ulcus simplex ilei seem to occur with equal frequency. Some investigators have found a slight majority in the ileum. Up to 1942 EBELING had collected 42 cases of simple jejunal ulcer. In 1940 MANGIONE added 9, one of which he had described personally. With the case to be described below the total thus comes to 52.

Case Report.

The patient was a 26-year-old chauffeur who was admitted to Ullevål Hospital, Dept. III on February 13, 1944, as an emergency case, suspect for perforated stomach ulcer. In 1932 he had been operated for a perforated appendicitis with peritonitis. Drainage only was performed. After this operation he was troubled by periodic dyspepsia, characterized by pains in the umbilical region about 2 hours p. c. as well as acidic belching. He had symptom free intervals of up to 3 months. At the time of admission he was imprisoned by the German occupation forces. While in prison he had dyspepsia. About 14 days before admission to Ullevål, Dept. III, he developed melæna. For this he was given a kind of diet, $\frac{1}{2}$ litre milk per day and a little white bread, but otherwise the ordinary prison fare, e. g. salt herring. His fæces were black until a couple of days before admission. On February 13 at 6 o'clock in the evening he suddenly had violent pains in the entire abdomen. The pains were accentuated by coughing and any movement. He was nauseated and vomited several times. He was given morphine drops which he immediately vomited up again. As the pains persisted a physician was called and he was immediately sent to Ullevål Hospital, Dept. III. His fæces had been normal the last two days. Urination normal.

Status præsens Feb. 13, 10.30 P. M. The patient is in fair condition, he appears to be in a bad way. Lies with his knees drawn up and complains of pains which are worse when he breathes deeply or makes any kind of movement. Temp.: 38.5. P.: 120 rm. B. P.: 135/80. Resp.: 34, short. Tongue: moist, clear. No edema or exanthema. Cor/Pulm.: normal.

Abdomen: Taut and hard over the entire region. Extreme sensitivity to pressure and release everywhere.

Exploration: Sensitive to palpation toward the peritoneum. No tumor could be felt.

Urine: Some red blood corpuscles microscopically, otherwise normal.

Roentgen examination revealed a slight colon meteorism, otherwise nothing particular. Especially no pneumoperitoneum.

About 6 hours after the onset of the attack a spinal anaesthesia was administered on the probable diagnosis perforated stomach ulcer:

Laparotomia. Excisio et sutura ulceris perf. jejuni. (HÖYER.)

Right diarectal section in the epigastrium. There was no free air or exsudation in the upper part of the abdominal cavity. The stomach and duodenum were searched and found normal. The colon transversum was considerably swollen with gas and was drawn forward. An abundant, seropurulent, odorless exsudate then ran out of the lower part of the abdominal cavity. The small intestine was then examined, beginning at the ileocecal part. The appendix was somewhat adhered but otherwise normal. About 50 cm. from the flexura duodeno-jejunalis on the free border of the intestine there was a round perforation opening about 5 mm. in diameter, surrounded by a coating of fibrin in an area about 2.5 cm. in diameter. Considerable thickening of the intestinal wall in the same area. Its appearance was completely analogous to that of an *ulcus perforans ventriculi sive duodeni*. The intestine otherwise was of normal appearance. Excision of the pathologically altered intestinal region was performed, almost like a wedge resection with subsequent suture of the intestine transversely to the longitudinal axis. (Fig. 1.) The suture was made with continuous cat-gut in 3 separate portions and silk knot sutures in the serosa. The intestinal lumen at the point of suture was large enough to admit a thumb. The abdominal cavity was washed out with physiological saline solution and in conclusion 100 cc. 5 % sulfathiazol solution was poured in. Complete closure of the wound.

The removed piece of intestine exhibited on the inside a round ulcer, the size of a finger tip, with a round perforation about 5 mm in diameter at its base. In appearance it resembled a perforated gastro-duodenal ulcer in every respect. Microscopical examination of the ulcer revealed no tumor tissue or indications of specific inflammation. However there was considerable infiltration of round cells with polynuclear leucocytes and plasma cells in the immediate surroundings of the ulcer. The ulcer was located in ordinary jejunal mucous membrane.

With the exception of a protracted infection in the abdominal wound, the post-operative progress was uncomplicated. EWALD's test meal on April 12, 1944, gave the acid figures 11/23 and on a later examination 37/46. Roentgen examination of the ventriculus/duodenum on March 3, 1944 showed nothing abnormal. No alterations could be seen at the site of operation (Fig. 2). Wassermann neg. Kahn neg. M. K. R. II neg.

Pathological anatomy: The ulcer described agrees completely with the definition of an *ulcus simplex jejuni*. The description of these ulcers is quite uniform. A round or oval, sharply limited loss of substance which narrows conically towards the base with an eventual perforation opening. The ulcer is surrounded by considerable, sometimes very firm, thickening of the intestinal wall. The ulcers are almost always located on the convexity of the intestine. The ulcer has been found on the mesenterial side in only

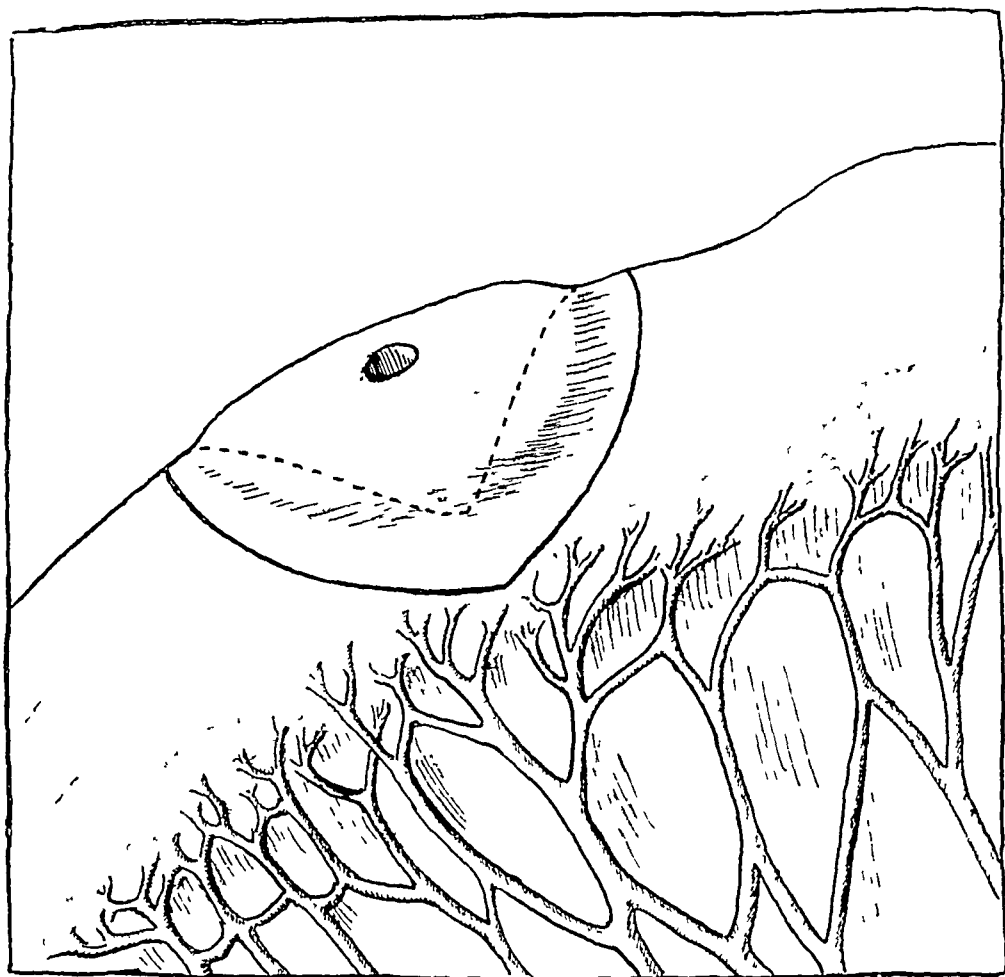


Fig. 1. Drawing showing the perforated jejunal ulcer and the excision line.



FIG. 2. Examination after a contrast meal 18 days after the operation.
The site of the excised ulcer could not be demonstrated.

2 cases. Usually there is only one ulcer, but 2 or more have been reported. The microscopical examination has shown pronounced round cell infiltration of no specific character.

The *etiology and pathogenesis* are unknown. A primary lesion of the mucous membrane, caused by a foreign body for example, has been assumed to be a possible etiological factor, also local embolisms and thromboses. In one case gastric mucous membrane was found around the ulcer (H. PUHL 1933). Otherwise the ulcers have always been surrounded by ordinary intestinal mucous membrane. GRASSMANN has induced experimental ulcer simplex in dogs by means of lesion of the mucous membrane and sub-mucous injection of formalin. GALLAGHER has induced simple ulcers by the application of pinching forceps. In 1932 MATTHEWS performed the following experiment: In 6 dogs with Pavlov's stomach, this was anastomosed with the ileum. In all of them chronic ileum ulcers were induced, some with perforation.

As regards the *symptomatology* the affection exhibits few or no symptoms until after perforation has taken place. In some cases there is an uncharacteristic dyspepsia, often periodic and not rarely accompanied by melæna (BROWN and PEMBERTON). The condition may have been present for many years. WOLTEN describes a 45 year old woman who had had periodic dyspepsia for 19 years. Operation revealed a callous ulcer in the upper part of the jejunum. The stomach and duodenum were normal. In the present case the dyspepsia was of 12 years' duration. When perforation occurs the picture resembles a perforation peritonitis which is difficult to distinguish from perforation peritonites of other origins.

The *diagnosis* is usually not made before on the operating table or the post mortem examination, and in the large majority of the reported cases not until after perforation has occurred. In 1928 HORTHAUSER compiled 54 cases of simple intestinal ulcers of which 50 had perforated. Of the 42 simple jejunal ulcers which EBELING compiled in 1933, 35 were perforated. The ulcers which have been operated before perforation have either been operated on the diagnosis gastric ulcer or chronic appendicitis. It has hitherto not been possible to diagnose a non-perforated ulcer simplex in the small intestine by means of roentgen. But there must be a possibility of doing this when the ulcer is located to the upper part of the jejunum. When confronted with dyspepsia and occult hemorrhage or melæna, where the stomach and duodenum

are found normal, intestinal ulcer (as well as ulcer in Meckel's diverticulum) should be borne in mind. And similarly in peritonites where the site of origin cannot be found at the usual places, a perforated intestinal ulcer should be looked for. SCHILLING states that the ulcers are practically always found at the upper or lower parts of the intestine. The perforation opening may often be difficult to find. It has happened that it has not been found on operation, but first on post mortem examination (WISLÖFF). MORRIN claims that regionally swollen mesenterial glands may point the way to the ulcer.

Therapy. Most authors recommend resection of the intestine as closing of the perforation opening has given suture insufficiency. In cases where the ulcer is located on the free edge of the intestine, which is the most common, and where the ulcer does not infiltrate the mesenterial surface, an excision of the ulcer with subsequent suture transverse to the longitudinal axis of the intestine is to be recommended (Fig. 1). The method is simple and takes little time to perform. A reliable suture is obtained in healthy tissue, and as the mesenterial surface of the intestine is intact the point of suture will receive the best possible nourishment. The author has also employed this method successfully in a number of cases of incarcerated, gangrenous hernias of the intestinal wall. (LITTRÉ.)

The *prognosis* for the perforated ulcers is grave. EBELING finds 60 % mortality, SCHILLING 84 %. With modern chemo-therapy the prognosis will probably prove to be very much better.

Summary.

The author reports a case of perforated *ulcus simplex jejuni* in a 26-year-old man. The ulcer, which was located about 50 cm. from the flexura duodeno-jejunalis, was excised and sutured. Except for some infection in the abdominal wound the progress was uncomplicated.

Simple ulcers in the small intestine are rare. In all about 100 cases have been reported in the literature of which 52 are localized to the jejunum. The ulcers are rarely recognized before perforation occurs. The condition is often accompanied by dyspepsia, and not rarely by *melæna* (which was true in the present case). The mortality on perforation is very high, 60—80 %. Treatment should consist of resection, or excision of the ulcer. Simple closure of the opening has led to suture insufficiency.

Zusammenfassung.

Der Verfasser beschreibt einen Fall von perforiertem *ulcus simplex jejuni* bei einem Mann, 26 Jahre alt. Das Geschwür, das ungefähr 50 cm. von *flexura duodeno-jejunalis* entfernt war, wurde excidiert und genäht. Abgesehen von einer Infektion in der Bauchwand, war der Verlauf unkompliziert.

Ulcus simplex im Dünndarm ist selten. In allem sind etwa 100 Fälle in der Literatur beschrieben, von denen 52 im Jejunum lokalisiert waren. Die Geschwüre werden nur ausnahmsweise vor der Perforation erkannt. Der Zustand wird oft von Dyspepsie und nicht selten von *Meläna* (was im besprochenen Kasus der Fall war) begleitet.

Die Mortalität ist bei Perforationen sehr hoch, 60—80 %. Die Behandlung durfte im Resection oder Excision bestehen. Einfache Übernähung hat Suturen-Insuffizienz gegeben.

Résumé.

L'auteur rend compte d'un cas de simple ulcère de jejunum (*ulcus simplex jejuni*) perforé, chez un homme de 26 ans. L'ulcère, qui était situé à 50 cm. environ de la jonction duodénum-jejunum (*flexura duodeno-jejunalis*), fut excisé et suturé. Abstraction faite d'une certaine infection de la plaie extérieure le développement s'achevait sans complications.

Les ulcères simples (*ulcus simplex*) de l'intestin grêle sont rares. On en trouve dans la littérature un total d'environ 100 cas, dont 52 localisés au jejunum. Les ulcères ne sont qu'exceptionnellement constatés avant la perforation. L'état est souvent accompagné de dyspepsie, et l'apparition de sang dans les fèces (*melaena*), ce qui fut constaté dans le cas en question, n'est pas rare. En cas de perforation la mortalité est très élevée, 60—80 %. Le traitement doit se faire par résection ou excision de l'ulcère. Suture toute seule a été accompagnée d'insuffisance de la suture.

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On Conservative Surgery in Hydronephrosis.

By

RUDOLF BRANDBERG and BJÖRN KÖHLER.

The operative methods which have developed for conservative treatment of hydronephrosis and which, although somewhat modified still are used, were designed as early as towards the end of the 19th century. In spite of this, the organconserving operations have however with certain exceptions not been used to any great extent in the surgery of hydronephrosis previous to the last decades. During this later period organconserving operations have here as in the urologic surgery on the whole been more and more aimed at; at the same time better methods of examination, above all the urography, together with increased tendency of the public to seek medical attention have created the requirements for early diagnosis and consequently for conservative surgical measures. In the matter of hydronephrosis we may not however set great hopes upon disease being diagnosed before the enlargement of the organ has reached such a point that nephrectomy is the only resource. As KÖHLER has shown in a large number of cases of hydronephrosis the disease often and particularly so in women runs its course without symptoms and gives no signs until an infection intervenes. In these cases the diagnosis will consequently not be established before such an advanced stage has been reached that an organconserving operation is either out of the question or very risky.

The increased experience in the matter of hydronephrosis has shown for one thing that the disease not infrequently appears in both kidneys and for another that in unilateral hydronephrosis the pelvis of the other kidney sometimes shows an anomaly of

shape indicating that it is what has been called potentially hydronephrotic (SARGENT, MOORE and others).

The developmental defect which more and more is considered to be the original cause of the hydronephrosis is as a matter of fact often bilateral. If a hydronephrotic but rather well functioning kidney is extirpated, this will now and again cause the disposition towards disease in the pelvis of the other kidney to turn into real disease. The misshapen pelvis has been able to cope with the passage of the normal amount of urine; the larger quantity that has to pass when the other kidney has been removed cannot obtain an unimpeded outflow; retention appears and a progressive hydronephrotic state develops. It is consequently, as pointed out by SARGENT and others, not uncommon that a patient in whom a hydronephrotic but rather well functioning kidney has been removed will come back a couple of years later with a hydronephrosis of the remaining kidney.

Infection of a hydronephrosis was previously considered to be an obstacle to conservative surgery. The flaring up of the infection in connection with the intervention has been a cause of life-threatening inflammations and has been a risk for the final result of the operation. As pointed out by QUINLEY a remaining infection even after a technically successful operation can give rise to progressive impairment of the kidney function and thereby in the long run obscure the operative result. The efficient urinary antiseptics that have come into existence during the last years, above all the sulpha drugs, ought to carry with them a definite amelioration in this respect.

Summarising the above statements we can say with certainty that the need and desirability of conservative surgery in hydronephrosis is obvious and that the possibility and the chance of realizing it with a successful issue has increased during the last decade.

In estimating the justification of the various conservative interventions and their chance to restore normal conditions in hydronephrosis we have to consider the various causes of hydronephrosis. The following is a brief account of them. In this paper only those hydronephroses which can be labelled primary are taken into consideration whereas those which are due to another obvious disease — calculus, tumour etc. — and consequently can be labelled secondary are omitted. In most true hydronephroses the hindrance to the outflow is situated at the ureteropelvic

junction. The obstruction is rarely localised to the lower part of the ureter or to its opening into the bladder. In these latter cases in addition to the enlargement of the pelvis there also arises a widening of the ureter. The cases of such hydronephroses with hydroureter constitute a separate problem which will not be discussed in this paper. The causes of hydronephrosis are generally divided into 1. congenital, 2. inflammatory and 3. traumatic. The two latter groups which certainly are rather rare, offer no great fundamental interest as here well known pathological conditions exist.

The changes which by more and more authors are interpreted as congenital malformations and which are considered as the most common cause of hydronephrosis are of much greater interest. The changes concerned are above all in the wall of the ureter strictures and folds and outside it connective tissue strings which press the ureter flat or fibrous streaks which fix the upper part of the ureter to the pelvis and thereby cause an obstructing kink. The changes referred to exist either alone or simultaneously. ÖSTLING has shown in his dissertation that such changes are to be found rather often during the early development of the foetus and consequently ought to be considered as developmental disturbances. ÖSTLING finds a further support for this view in the fact that the changes in question never show signs of a continued or healed inflammation in the histological picture.

The importance of accessory renal vessels for the origin of hydronephrosis has perhaps been taken more into consideration in our country than elsewhere. Swedish authors, among whom should be mentioned in the first place EKEHORN, G. PETRÉN, SÖDERLUND, HELLSTRÖM and BERGENDAL, have made important contributions to the solution of this problem. Accessory renal arteries are, according to the investigations of BERGENDAL and of HELLSTRÖM, rather common and often exist without causing a hydronephrosis. The rule of EKEHORN that only those vessels which pass the ureter on the opposite side of that on which they enter the kidney cause an obstruction, partly explains this phenomenon. In the literature outside Scandinavia the opinion is often expressed that the accessory renal vessels are not the primary cause of the hydronephrosis, but only contribute to and hasten the development of a hydronephrosis originating from the above mentioned congenital malformations. These latter are also often demonstrable simultaneously with accessory vessels. ÖSTLING sup-

poses that the accessory artery in such cases can cause an obstruction to the outflow of the urine particularly in rotations of the kidney. The good results of the ligature of an accessory vessel, that BERGENDAL has been able to demonstrate on a big material of hydronephroses are however strongly in support of the opinion that these vessels play the principal part in the origin of these pathological conditions (see below).

In addition to the mechanical causes mentioned above it is now very generally thought that a hydronephrosis can arise from purely dynamic origin. It is supposed either that a continued spastic state of contraction at the ureteropelvic junction prevents the escape of the urine from the pelvis and thereby causes the hydronephrosis or that a simple atony of the pelvis leads to such a degree of stagnation that a hydronephrosis results. For such conditions a deficient innervation or a faulty equilibrium between contracting and dilating nerves plays an important part in the same way as for instance in megacolon. The theory of the dynamic origin of hydronephrosis finds its strongest support in the fact that it is impossible in some cases of hydronephrosis to point out any mechanical obstacle to the outflow at all. To all hydronephroses the continued dilatation adds of course a distension with paresis and damage to the wall, which reduce the chances of emptying the pelvis and hasten the progress of the hydronephrosis.

With regard to the treatment of hydronephrosis one can observe first of all that many of the smaller ones which do not cause any inconvenience to the patient and which do not tend to increase in size do not afford any reason to interference at all.

Many operative methods have been suggested and used for conservative treatment of hydronephroses. In this paper only those are taken into consideration which aim at restoring the normal outflow of the urine to the ureter and the bladder. An obstacle caused by small fibrous streaks is of course overcome by removing these. As however simultaneously with them obstacles of a kind stated below, are not infrequently found further therapeutic measures will often be necessary.

In order to remove the obstruction to the outflow caused by strictures, folds and kinks at the ureteropelvic junction the operation of FENGER is used. The narrowed area is split by a longitudinal incision which is then sutured transversely. SCHWYZER (1916) and later FOLEY have tried to avoid the bulge that is

apt to arise in this connection at the opposite side of the suture by making the incision V- or Y-shaped. GIBSON tries to eliminate the obstacle to the passage caused by strictures by splitting the outer layers of the wall in the narrowed area — in the manner used at the operation of RAMSTEDT in pyloric stenosis of the newborn — dilating the obstruction and applying a catheter during the stage of healing. When there is a kink caused by fibrous streaks between the pelvis and the upper part of the ureter it is possible either to make a plastic operation at the ureteropelvic junction — as in pyloroplasty according to FINNEY — or to make an anastomosis between the pelvis and the upper part of the ureter — as in ordinary gastroenterostomy.

While the operations mentioned need not involve any interruption of continuity between the pelvis and the ureter — many authors consider this to be a great advantage — KÜSTER has suggested the excision of the changed part at the ureteropelvic junction and the transplanting of the top of the ureter somewhere else into the pelvis, as a rule in its most caudal part. LUBASH and MADRID have suggested a special technic for performing this ureteropyeloneostomy.

Excision of a part of the enlarged pelvis in order to reduce this to a more normal size is an intervention that has been used in such cases where no mechanical obstacle to the outflow has been observed. An operation equivalent to the excision is the folding of the pelvis wall which however seems to have no particular use to speak of.

In all interventions where the pelvis-ureter are opened most authors advise that a pyelo- or nephrostomy is made at the same time. It is of course particularly important to attain a good result that the urine during the period of healing has an easy outflow and that any stagnation thereof is avoided. The value of this measure cannot be exaggerated (SARGENT and others).

In hydronephrosis connected with an accessory vessel the intervention most used in our country has been the ligature and division, possibly the resection of the vessel. This procedure involves however a risk for necrosis or malnutrition in a big part of the renal parenchyma especially if the vessel in question is a big artery. In the material of BERGENDAL containing 77 cases, necrosis arose from this cause in two cases certainly, in two others probably and in six further cases possibly. It was not necessary to perform a nephrectomy in any of these cases. Hypertension

caused by a Goldblatt-mechanism has been brought about in the two cases which after the operation showed positive signs of infarction. HELLSTRÖM has successfully been able to remove the pressure of accessory vessels on the ureteropelvic junction by dislocating and fastening the vessel high up on the pelvis where its pressure cannot be any obstacle to the outflow. Another method of avoiding the resection of an accessory vessel was designed by HJORT. This author performs an anastomosis on the pelvis around the vessel. The method of HELLSTRÖM is certainly more useful. The authors which attribute to the accessory vessels only a secondary value for the origin of hydronephrosis do not divide the vessel, but only seek to remove the obstacle to the outflow by any of the operative measures mentioned above, as a rule probably a ureteropyeloneostomy.

The necessity of resorting to a conservative operation is obvious in the following cases:

1. A remaining kidney with hydronephrosis. The most common case is probably that the other kidney has previously been removed for hydronephrosis but of course another disease may also have been the cause of the extirpation of the kidney. The conditions are of course the same if the corresponding kidney exists but is gravely affected and shows no function at all or a reduced one.

2. In hydronephrosis of both kidneys including cases where a so-called potential hydronephrosis is to be considered as existing in the other kidney.

On the other hand it is important to state in which cases conservative surgery is not to be used provided that the other kidney is healthy and therefore there is the possibility of a nephrectomy. If the renal parenchyma is so damaged that the functional capacity of the kidney after a successful conservative operation can be expected to amount only to half the normal or less, nephrectomy is usually advised. Infection and formation of stones in a hydronephrosis were each in themselves previously considered to be an indication for nephrectomy. Later the opinion has been stated that it is advisable in infections of a mild degree and in certain formations of stone to try an organconserving operation.

The majority of the hydronephroses, where surgery has the opportunity to choose between a conservative intervention and the excision of the kidney, fall between the groups where conservative surgery is the only possibility and where such inter-

ventions should never be performed. A few authors (FOLEY, SARGENT and others) hold the opinion that in all such cases a conservative operation should be tried and the kidney should be removed only when the intervention has failed. Other authors (WALTERS, CABOT and PRIESTLEY) wish to spare the conservative interventions for children and for women in the ages where pregnancy can be expected. For the children who have life ahead and for women whose urinary apparatus can be exposed to the strains and dangers of a pregnancy these authors consider that the one-kidney-state implies so obvious a risk that it is to be avoided as far as possible. For other groups this state should be less dangerous and here nephrectomy is consequently to be preferred to conservative surgery with its — as will be shown below — more uncertain chances. The accuracy of this latter view is however questionable. As KÖHLER has shown all nephrectomized people run an increased risk of becoming subject to urological as well as vascular diseases on account of which nephrectomy ought to be kept for the cases where it is an unavoidable necessity.

The question about to what extent a conservative surgery of hydronephrosis may be possible is of course highly dependent on the results which this surgery is able to produce. The results, especially the permanent ones, are elucidated by a number of investigations among which a few will be briefly referred to below. It is essential that the patients be examined with urography if a follow-up is to be relied upon. Experience has as a matter of fact shown that patients can be entirely free from subjective symptoms and present a normal clinical state and yet the hydronephrosis has continued to increase after the operation.

Opinions are divided as to the chances of the pelvis to be restored after operation. A few authors think that a restoration even after a successful intervention occurs rather incompletely or not at all. The state of hydronephrosis has often brought about such changes of the pelvis wall that its capacity to retract has been lost to a large extent. Others are more hopeful in this respect. If the results of a conservative operation for hydronephrosis are judged according to the change in size of the pelvis that occurs there are the following possibilities.

1. The pelvis is restored to a somewhat normal shape and size. The result must be marked as a good one.

2. A satisfactory result has been arrived at if the pelvis has diminished in size and a good function of the kidney exists. The

emptying of the pelvis is of course in these cases more or less delayed.

3. The result is bad if after the operation the hydronephrosis has continued to increase in size.

The mortality in conservative surgery of hydronephrosis is low. The most common fatal complication is a severe infection of the wound and its surroundings arising from contamination by the opened, infected pelvis. The most common causes for the failure of the conservative surgery of hydronephrosis are as follows:

A satisfactory outflow of the urine from the pelvis through the ureter to the bladder has not been established and the stagnation persists. This leads to an increase in size of the hydronephrosis and a further destruction of the renal parenchyma. In cases where the pelvis has been opened during the operation the persisting obstruction may cause a permanent fistula to develop. Continuous and progressive infection as well as formation of stones is in most cases a consequence of bad drainage. These complications are only found exceptionally if there is no such cause.

A failure of a conservative intervention for hydronephrosis is in most cases followed by nephrectomy. This may be technically difficult owing to perinephritic changes.

The following results may be quoted from the statistics that give the results of conservative operations.

In the material of ZUCKERKANDL (1921) comprising eight cases 50 % underwent secondary nephrectomy.

SCHOLL, STARR and JUDD (1924) report on eleven secondary nephrectomies in 39 cases.

WILDBOLZ (1931) has 14 cases of plastic operations with good results in 13 of them, secondary nephrectomy only in one patient.

HRYNTSCHAK (1936) obtained satisfactory results in nine out of 12 plastic operations.

BERGENDAL (1936) has followed up 62 cases of hydronephrosis connected with accessory vessels, where ligation of the vessel has been carried out. 45 patients were free from symptoms and 15 had slight trouble. Only two showed no improvement and in these cases only a vein had been tied. In this material 35 cases could be checked by urography. In 26 cases the pelvis had diminished in size, in ten the size was unchanged and in two cases

finally the hydronephrosis had increased in size after the operation.

CREEVY (1937) has nine plastic operations with good results in eight of them.

SARGENT (1937) reports on ten patients among whom were two with bilateral hydronephrosis. Conservative intervention gave excellent result six times, satisfactory five times and failed once.

FOLEY (1937) reports on 19 cases where the operative method suggested by himself has been used. Two postoperative deaths occurred. Good results were obtained in 13 cases, unsatisfactory in four cases.

WALTERS, CABOT and PRIESTLEY (1937) report on the material of conservative interventions in hydronephrosis from the Mayo clinic. It comprised 71 cases. Two postoperative deaths occurred. In 15 cases a secondary nephrectomy was necessary. Of 26 cases which could be checked by urography five showed an excellent and eight a satisfactory result. Five patients showed improvement and eight were unchanged. 20 patients had given a report on their condition in a letter. Seven were healthy, eight showed improvement and five no improvement. — The operative methods used gave the following results. Of 21 cases of resection of the pelvis nine could be checked by pyelo- or urography. Four showed excellent results and one a good result, one showed improvement and three no improvement. In nine cases in addition to the resection a ureteropyeloneostomy had also been made. In four cases judged after pyelography three gave good results and one showed improvement. Out of five cases according to their letters two cases gave good results, one case showed improvement and two no improvement.

PETRÉN reports (1939) three cases where the operation of Fenger has been performed. In all cases a good result had been obtained, the patients being free from symptoms and urography showing a diminished dilatation of the pelvis and better outflow.

MOORE reports in his latest work (1942) on the results of conservative surgery of hydronephrosis the outcome of 18 treated cases, among whom were two bilateral ones. No death has occurred. In three cases secondary nephrectomy was necessary and in one further case urography showed progression of the hydronephrosis. The best results were obtained in lateral anastomosis and in plastic operation according to FOLEY; here nine cases out of ten were restored. In four cases of hydronephrosis with accessory ves-

sel where the vessel had been tied, urography showed unsatisfactory results, while in two such cases ureteropyeloneostomy had given a successful result.

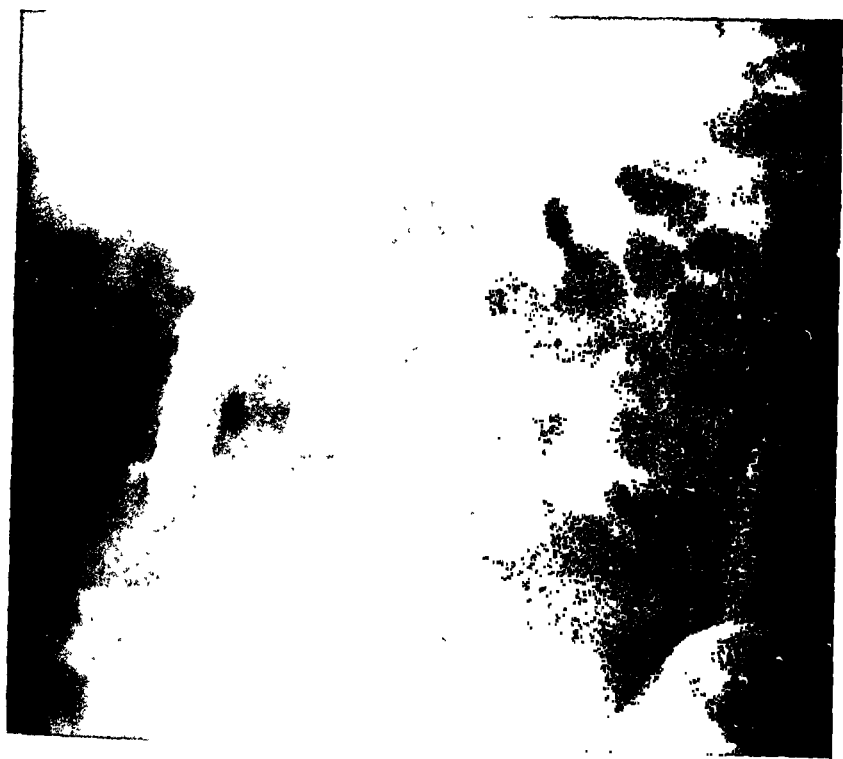
The authors' material.

Case 1. Woman, 39 years old. Three years ago the patient had an attack of pains in the right renal region with haematuria. In the autumn of 1940 she had a period of cystitic trouble and the last month before admission she had permanent pains in the right renal region. On 7. 2. 1941 profuse bleeding with the urine. Admitted to the surgical department of the Maria hospital on 8. 2. 1941. Conditions on admission: macroscopic haematuria. The sediment contains abundant erythrocytes, numerous leukocytes and gramnegative bacteria. N. P. N. 36 mgm%. X-ray: In the shadow of the right kidney a stratified concretion large as a nut is observed. At urography two pelves are noticed on the left side each with a ureter which do not unite until just before the orifice in the bladder. There is on the right side a large pelvis with club-like, dilated calyces. The concretion is situated in one of the upper calyces. Operation on 20. 2. 1941. Pyelolithotomia + Pyeloureteroplasty. The pelvis is moderately dilated. At the boundary between pelvis and ureter is a high-grade stricture of the lumen; the surrounding tissue is fibrous and thick. The lowest part of the pelvis wall is incised and the concretion extracted. From the incision in the pelvis the cut is continued down in the ureter until this gets a normal lumen. The incision is then sutured transversely. Drainage of the operation cavity with a tube, the rest of the wound is sutured. The following course was uneventful. On discharge from the hospital on 8. 3. the urine contained the following sediment: an occasional erythrocyte, some twenty leukocytes per visual field, gramnegative rod-shaped bacteria. Follow-up on 2. 10. 1945: Since the operation the patient has been entirely free from symptoms from the urinary passages. The urine is normal. At urography there occurs after five minutes a simultaneous filling of both pelves with contrast. The right pelvis is only slightly dilated and the evacuation occurs in a normal manner.

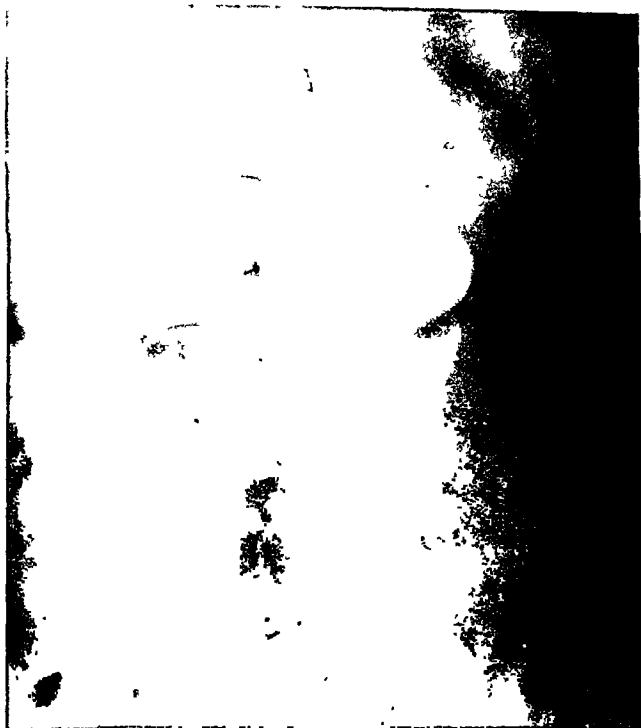
Case 2. Woman, 63 years old, treated at the surgical department of the Maria hospital 30. 11. 1943—12. 2. 1944. In 1912 a partial resection of a big, right-sided hydronephrosis was made. In 1918 it was necessary to excise the right kidney on account of infection. The patient has since then been in the main free from symptoms from the urinary passages until 19. 11. 1943 when she was taken ill with an aching pain in the left renal region, dysuria and fever about 39 degr. These symptoms have since persisted. Condition on admission on 30. 11. 1943: Fever 38.8. At the site of the left kidney a tumour is palpated, larger than a fist, rounded and slightly tender. Sediment: numerous leukocytes and coli bacteria. N. P. N. 44 mgm%. Sedimentation test



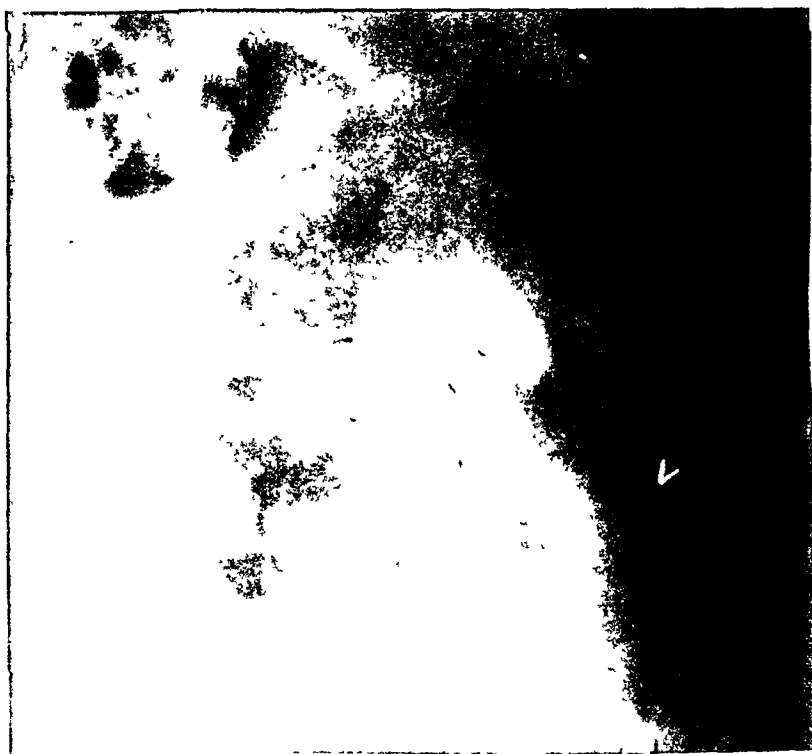
Case I. 1. Hydronephrosis of the right kidney with a stratified calculus and infection.



2. $4\frac{1}{2}$ years after the operation. No recurrence of stone. The urine is normal.



Case 2. 1. Hydronephrosis of a remaining kidney after nephrectomy + Solitary renal cyst + Infection.



2. 1 1/2 years after the operation. The pelvis is somewhat dilated. No obstruction is visible. The urine is normal.



Case 3. 1. Hydronephrosis of the left kidney.

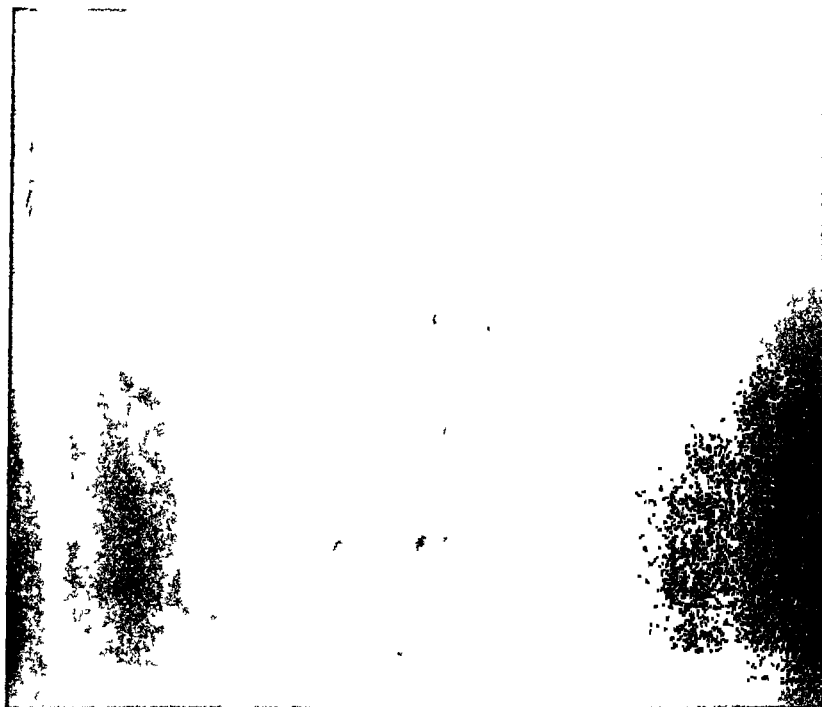


2. $1\frac{1}{2}$ years after the operation. Simultaneous excretion on both sides. The left pelvis is of normal size and shape. The urine is normal.

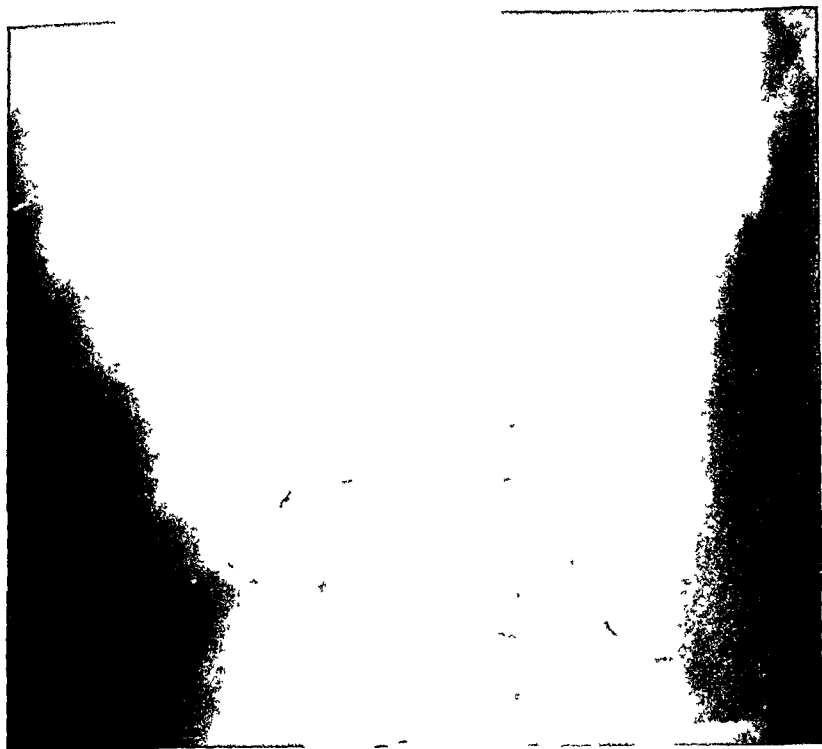
BRANDBERG and KÖHLER: Conservative Surgery in Hydronephrosis.



Case 1. 1. Hydronephrosis of the left kidney.



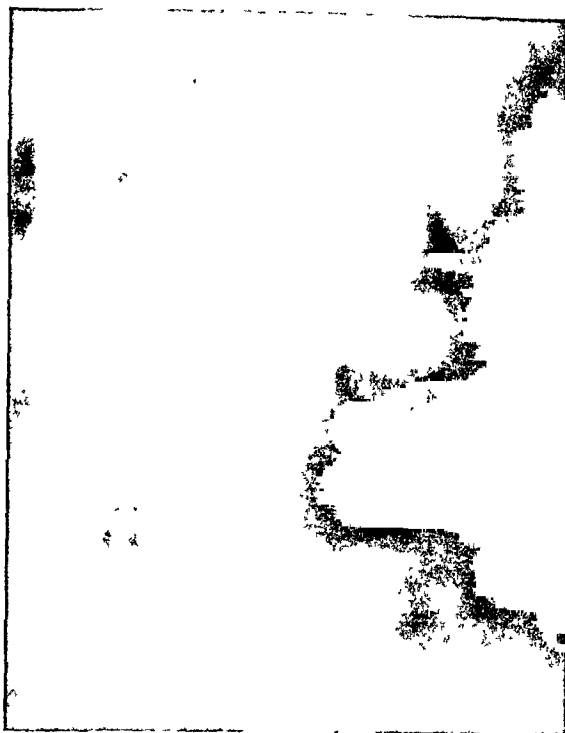
2. One year after the operation, Urography shows the same picture as before the operation and the excretion is delayed. No subjective complaints. The urine is normal.



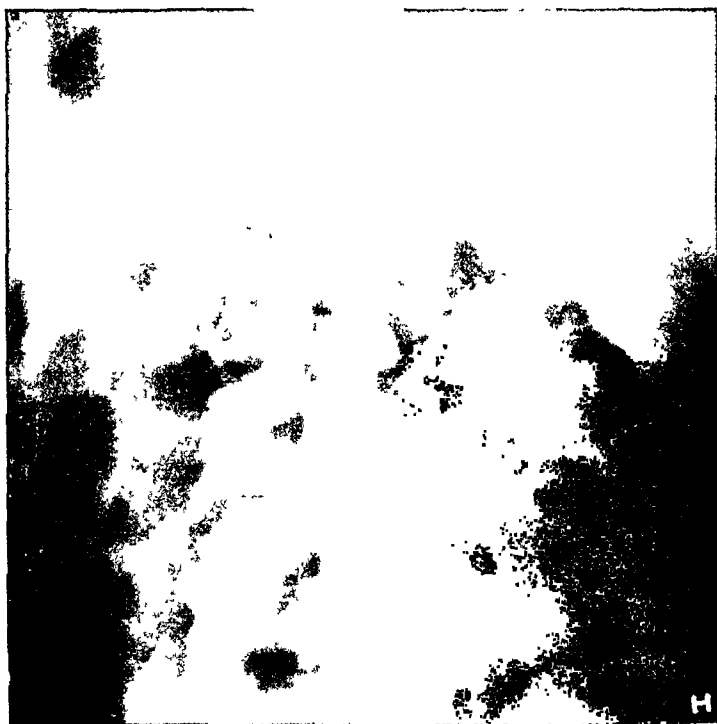
Case 5. 1. Bilateral hydronephrosis. Delayed excretion on both sides.



2. Six months after the operation. Both pelves show a marked decrease of the hydronephrotic changes but they are still considerably dilated. Better excretion on both sides. The urine is normal.



Case 6. 1. Hydronephrosis of the right kidney.



2 Five months after the operation. The pelvis has diminished to half the size and the excretion is good. The urine is normal.

89 mm/hour. X-ray on 2. 12. 1943: At urography a somewhat late filling with contrast of a widely dilated and deformed pelvis is obtained. The pelvis itself measures in height and in breadth 10 and 6 cm respectively. The calyces are very dilated and the uppermost which is the largest is as big as a tangerine. The palpable tumour comes from the middle and lower part of the kidney and deforms somewhat the lower calyces. Operation on 7. 12. 1943: Excision of a renal cyst + Pyeloureteroplasty + Pyelostomy. The palpable tumour proves to be a renal cyst bigger than two fists and coming from the middle and lower part of the kidney. The free part of the wall of the cyst is excised. The renal parenchyma is rather well maintained. The pelvis is very dilated and the wall is somewhat swollen and reddened. The whole length of the ureter is narrow with a rather thin wall. The ureteropelvic junction is thickened. This area is split by an incision, 1 cm in length which then is sutured transversely. The pelvis is drained through a small tube which has been introduced through a separate incision in the pelvis wall. Drainage of the kidney region by means of a rubber tube of a finger's thickness: the rest of the wound is sutured. — Through the nephrostomy all urine emptied up to the end of December. Later small quantities began to take the normal course. It was not until the beginning of February that all the urine passed the normal way. The nephrostomy-tube could be dispensed with on 5. 2. 1944. On discharge from the hospital on 12. 2. 1944 the wound was healed. The general condition was good. The urine showed a continued infection and the patient was told to take urinary antiseptics periodically — sulfatiazol in medium doses. Follow-up December 1944 and May 1945. The patient feels well. She must get up for micturition once every night but has no other urinary trouble. The sediment contains a few leukocytes and erythrocytes per visual field. N. P. N. 40 mgm%. Urography: On the left side a somewhat dilated pelvis is seen with slightly wide calyces. No visible obstruction to the outflow.

Case 3. Woman, 22 years old. Since childhood the patient has occasionally had attacks of pains in the left renal region. Admitted during such an attack to the surgical department of Södersjukhuset on 15. 5. 1944. Condition on admission: No fever. Tenderness in the region of the left kidney. Sediment: a few erythrocytes, numerous leukocytes, gramnegative rods. Urography showed normal anatomy and normal conditions of excretion on the right side. On the left side a considerably dilated pelvis is filled with wide calyces. — On 23. 5. a resection of the pelvis was made. There is a considerable hydronephrosis. No obstruction of the lumen is visible at the junction between pelvis and ureter, nor are there any fibrous streaks or passing vessels which could bring about an obstacle to the outflow. The greater part of the hydronephrosis is excised and the cut edges are stitched to form an ordinary pelvis. The postoperative course was uneventful. On discharge on 6. 6. the wound was healed and the urine free from sediment. On 15. 8. 1944 an urography was made which showed that the pelvis was only slightly dilated and that the contrast passed without obstruction

down in the ureter. — Follow-up on 6. 11. 1945. The patient has had no subjective symptoms at all. The urine is normal. Urography shows simultaneous excretion on both sides. The left pelvis with its calyces has further diminished in size.

Case 4. Man, 40 years old, treated at the surgical department of Södersjukhuset 2. 8.—25. 8. and 7. 9.—27. 11. 1944 for bilateral hydronephrosis. The patient became acutely ill — having had no urinary symptoms before — the 2. 8. 1944 with severe pains in the right renal region and frequency of micturition. He was admitted to the hospital on the same day. Condition on admission: No fever. Some tenderness in the region of the right kidney. No sediment. N. P. N. 38 mgm%. Urography: Delayed excretion on both sides. Both pelvises with calyces are considerably dilated. The right ureter shows only a slight filling of the upper part. The left ureter is better filled. Right-sided retrograde pyelography on 3. 8.: The pelvis is still filled with contrast from the examination yesterday. The upper two cm of the ureter are constricted. In this area the ureter runs along with the anterior medial part of the pelvis. On the passage from the pelvis a high-grade kink on the ureter is hereby formed. Operation on 8. 8. Pelveoureteroplasty on the right side with pyelostomy. Ordinary lumbar incision. The pelvis is considerably distended. It is punctured and about 50 ccm of clear urine are drained off. The renal parenchyma is well maintained. The upper two cms of the ureter are considerably narrower than other visible parts and the wall feels fibrously thickened in the area mentioned. Only a thin probe can pass this portion. The affected area of the ureter is split from the pelvis and then sutured transversely. The pelvis is drained by means of a thin rubber tube introduced through a separate incision in the pelvis wall. Drainage of the kidney region, the rest of the wound is sutured. On 22. 8. the nephrostomy tube could be dispensed with. The patient was discharged healed on 25. 8. and was readmitted the 7. 9. for operation on the left side. On 11. 9. a pelveoureteroplasty was made on the left side with pyelostomy. The finding and the operative procedure were the same as on the right side. It was not until the middle of November that a satisfactory passage of urine down in the ureter was obtained and the pyelostomy-tube could be dispensed with. On discharge on 27. 11. the wound was completely healed but the urine continued to be infected. The patient had to continue with urinary antiseptics and was kept under observation at the outpatients department. Follow-up on 23. 5. 1945: The patient is completely free from subjective symptoms. The sediment is normal. The urography shows a normal start of the filling with contrast of both pelvises. These show a marked decrease of the hydronephrotic changes, but they are still considerably dilated. The pelvises now empty better than previously especially on the right side where a radiogram on standing shows that the pelvis is completely empty.

Case 5. Man, 19 years old. The patient had never had any symptoms from the urinary passages and became ill on 31. 8. 1944 with pains

in the left renal region and haematuria. The pains disappeared and reappeared again at times during the following days. Condition on admission on 11. 9.: No fever. No sediment. N. P. N. 38 mgm%. Urography: Somewhat delayed excretion on the left side where the pelvis and the calyces are considerably dilated. The whole length of the ureter is narrow right up to the distended pelvis, which indicates a relative obstruction at the ureteropelvic junction. A pelveouerteroplasty was made on 21. 9. Ordinary lumbar incision. The pelvis is moderately distended and is accessible only from in front. The upper end of the ureter lies embedded in fibrous streaks in a groove on the anterior surface of the kidney. The ureteropelvic junction is particularly tightened. When the upper part of the ureter has been isolated the ureteropelvic junction is split by a longitudinal incision of 1 cm:s length whereafter the incision is sutured transversely. A pyelostomy could not be made on account of the technical conditions. Drainage of the kidney region, the rest of the wound is sutured. The postoperative course was uneventful. On discharge on 5. 10. the patient was not free from sediment. He continued with urinary antiseptics and was kept under observation in the out-patients department. Follow-up on 25. 5. and 4. 10. 1945: The patient has no subjective complaints. No sediment. Urography shows the same picture of the pelvis as before operation and a delayed excretion.

Case 6. Man, 16 years old. Since spring 1944 the patient has had repeated attacks of severe pains in the right renal region. He was admitted to the surgical department of Södersjukhuset after such an attack on 31. 8. 1945. Condition on admission: No fever. The sediment contains 10—15 leukocytes per visual field, otherwise nil. N. P. N. 23 mgm%. The urography shows normal anatomy and normal conditions of excretion on the left side. On the right side the excretion begins slowly and here a considerable dilated pelvis with very widened calyces is only gradually filled. The right ureter is only partly filled. On 17. 9. a pelveoureteroplasty was made with pyelostomy. The kidney is of normal size and the parenchyma is well maintained. The pelvis is moderately distended. There is on the back at the boundary between pelvis and ureter a strongly tightening firm connective tissue string. This is dissected and divided. No vessel could be seen here. There is a considerable thickening of the wall with narrowing of the lumen at the ureteropelvic junction. The area in question is split and stitched according to Foley. A pyelostomy is made. The postoperative course was uneventful. Two weeks after the operation the urine began to pass the right way and on 4. 10. the pyelostomy tube could be dispensed with. On discharge on 6. 10. the patient was on the whole healed, but the urine contained numerous leukocytes and diplococci. In January 1946 the urine was sterile after repeated examinations. The urography showed that the pelvis and its calyces had diminished to half the size and that the evacuation was considerably more rapid than before.

To the reported cases following comment may be added. In five cases of hydronephrosis caused by congenital folds and stric-

tures at the ureteropelvic junction this area was split by a longitudinal incision and the cut was then sutured transversely. Also in case 2 where it was necessary to make an incision of some cm in length this procedure seems to have been successful. In two of the cases (5 and 6) in addition to the changes in the wall pathological conditions also were present outside the ureter to which some significance must be ascribed as an obstacle to the emptying. These extrinsic causes of obstruction were of course removed during the operation. In one case where no mechanical obstruction could be proved a resection of the pelvis was made.

All six patients are free from subjective symptoms and have a normal urine. The period of observation is in case 1 nearly five years, in cases 2 and 3 one year and a half, in cases 4 and 5 nine months and in case 6 three months. In case 1 where formation of stone and infection and in case 2 where there was infection of the hydronephrosis the patient was freed from infection by a consequent medication with sulpha drugs after the operation. It was also possible to avoid a recurrent formation of stones. In the remaining cases the infection that resulted from the operative treatment has been killed with sulpha drugs.

In the cases 1 and 2 during the period of observation a practically complete reduction to normal size of the highly dilated pelvis has taken place. In case 2 the intervention has averted the immediate danger to life which was presented in the condition of the patient with a hydronephrosis of the remaining kidney. Also in case 4 where there was a bilateral hydronephrosis the operations have saved the patient from the renal insufficiency that would have been inevitable if the disease had been allowed to continue. At the follow-up with urography here could be shown an improved renal function with better emptying of the pelvis and a considerable reduction of their dilatation. As it is obvious that a dilatation of the pelvis needs a long time to diminish it is certainly permissible to hope for a further diminishing of the pelvis. The same is to be said about case 6 where a satisfactory result is obtained after three months which as time goes on ought to show further improvement. In case 3 the diminishing of the pelvis that was brought about by the operation has persisted and has been accompanied by a good emptying of the urine.

The least favourable result was achieved in case 5 where only an improved kidney function was obtained while the size of the pelvis remained unaltered.

The postoperative course in case 2 and in case 4 after the operation on the left side has afforded the noteworthy observation that about two months elapsed before a normal evacuation of the urine through the ureter was obtained. An attempt to close the pyelostomy-tube earlier caused in both cases pains and fever on account of pyelonephritis. The importance of draining the pelvis at the operation is as a consequence manifest. If this had not been done in these cases an unfavourable issue would have been likely. In spite of the long time that elapsed until a normal evacuation was established this was later on perfect. In both cases the infection could be kept within moderate limits as long as the pyelostomy was needed and could later be abolished with the aid of sulpha drugs. Another consequence is that formation of stones could hereby be avoided.

Summary.

The authors report on six cases of hydronephrosis where conservative surgery was used. In five cases where there was a kink or a stricture at the ureteropelvic junction an ureteropelveoplasty was made (with removing of fibrous streaks or connective tissue strings). In one case where no mechanical obstacle could be shown a resection of the pelvis was made.

In one case there was formation of stone and infection of the hydronephrosis. In another case the hydronephrosis had developed in a remaining kidney after nephrectomy and the patient was admitted to the hospital with symptoms of pyelonephritis. A case with bilateral hydronephrosis is to be found in the material where both sides were operated on.

In every case the patient has been free from subjective symptoms after the intervention and has got a normal urine. A follow-up with urography shows that the pelvis has been restored to normal size in two cases of ureteropyeloplasty and in the resection case. In the case with bilateral hydronephrosis the pelves have diminished considerably in size and their emptying has shown great improvement. In one case the size of the pelvis was unchanged. In one case a considerable reduction of the pelvis has been obtained but the pelvis not yet had time to diminish completely during the short period of observation.

The authors consider it possible — owing to the improved possibilities for combating urinary infections which medication

with sulpha drugs and penicillin afford — to use conservative surgery in all cases of hydronephrosis where the destruction of the renal parenchyma has not reached such a degree that it is out of question to save the kidney.

In the case of a mechanical obstacle a plastic operation or an anastomosis operation ought to be performed; if there is no mechanical obstruction a resection of the pelvis is the appropriate intervention.

At interventions where the pelvis is opened a pyelostomy ought if possible to be made as this involves better conditions of healing and a diminished risk to urinary fistula. In two cases it was not until two months had elapsed that a normal passage of the urine through the ureter was obtained and during this period the urine emptied through the pyelostomy-tube. In both cases the final result was excellent with a good emptying and a reduction of the hydronephrosis. This is certainly to be ascribed to the fact that a pyelostomy was made.

Zusammenfassung.

Die Verff. berichten über 6 Fälle von Hydronephrose, bei denen konservative Chirurgie zur Verwendung kam. Bei 5 Fällen, wo am Übergange vom Nierenbecken zum Ureter eine Klappenbildung oder Striktur vorlag, wurde eine Ureter-Nierenbeckenplastik ausgeführt (sowie Entfernen von Strängen oder Verwachsungen). In einem Falle, wo sich kein mechanisches Abflusshindernis nachweisen liess, wurde eine Resektion des Nierenbeckens vorgenommen.

In einem Falle lagen im Hydronephrosesack Konkrementbildung und Infektion vor. In einem anderen Falle betraf der Hydronephrosezustand eine restierende Niere, und der Kranke wurde mit Symptomen einer Pyelonephritis ins Krankenhaus eingeliefert. Ein Fall von doppelseitiger Hydronephrose ist in dem Material vorhanden; hier wurden beide Seiten operiert.

In sämtlichen Fällen sind die Kranken nach dem Eingriff subjektiv symptomfrei geworden und haben völlig normalen Harn. Nachkontrolle mittels Urographie zeigt, dass das Nierenbecken bei zwei Ureter-Pyeloplastikfällen sowie bei dem Resektionsfalle wieder im grossen ganzen normale Grösse angenommen hat. Bei dem Falle mit doppelseitiger Hydronephrose haben die Nieren-

becken an Grösse bedeutend abgenommen, und die Entleerung derselben hat sich bedeutend gebessert. In einem Falle ist die Grösse des Nierenbeckens unverändert. In einem Falle ist eine wesentliche Abnahme der Hydronephrose eingetreten, ohne dass das Nierenbecken sich in der kurzen Beobachtungszeit völlig zurückbilden konnte.

Die Verff. sind der Ansicht, dass jetzt, dank der durch die Medikation mit Sulfapräparaten bedingten besseren Möglichkeiten zur Beherrschung einer Harnwegsinfektion, bei sämtlichen Fällen von Hydronephrose konservative Chirurgie zu verwenden ist, wo die Zerstörung des Nierenparenchyms nicht so hochgradig ist, dass sie eine Schonung des Organs ausschliesst.

Bei mechanischer Verlegung ist irgend eine Form von plastischer Operation oder Anastomoseoperation zu verwenden; wenn sich kein mechanisches Abflusshindernis nachweisen lässt, so ist die Nierenbeckenresektion der zweckmässigste Eingriff.

Bei Eingriffen, bei denen das Nierenbecken eröffnet wird, ist wenn möglich Pyelostomie anzulegen, da man hierdurch günstigere Heilungsbedingungen schafft und die Gefahr einer Harnfistel vermindert. In 2 Fällen dauerte es etwa 2 Monate, ehe man normale Harnpassage durch den Ureter hinab erhielt, und in dieser Zeit entleerte sich der Harn durch den Pyelostomieschlauch. In beiden Fällen war das Endergebnis gut, mit guter Entleerung und Rückgang der Hydronephrose, und zwar ist dies sicherlich dem Umstande zuzuschreiben, dass eine Pyelostomie angelegt worden war.

Résumé.

Les auteurs relatent 6 cas d'hydronéphrose où la chirurgie conservatrice trouva son application. Dans cinq, où existait une valvule ou une stricture à la jonction du bassin et avec l'uretère, on pratiqua une plastie pyélo-urétérale (associée à la suppression de brides ou d'adhérences). Dans un, où aucun obstacle mécanique à l'écoulement de l'urine ne pouvait être mis en évidence, on fit une résection du bassin.

Chez un patient il y avait des concrétions et de l'infection dans le sac de l'hydronéphrose. Chez un autre le processus hydronéphrotique avait lésé le rein restant et le malade entra à l'hôpital avec des symptômes de pyélonéphrite. Il y a un cas d'hydronéphrose

bilatérale dans le matériel présenté; ici l'opération fut faite des deux côtés.

Dans tous les cas les malades après l'intervention ont été débarrassés de leurs symptômes subjectifs, et leur urine est devenue absolument normale. Des contrôles ultérieurs par urographie montrent que dans deux des cas de plastie pyélo-urétérale, ainsi que dans celui soumis à la résection, le bassinets est pratiquement revenu à des dimensions normales.

Dans celui d'hydronéphrose bilatérale les bassinets ont considérablement diminué de grandeur et leur évacuation s'est largement améliorée. Dans un cas le volume du bassinets est resté inchangé. Dans un autre, l'hydronéphrose s'est fortement rapetissée sans que, pendant la courte durée d'observation, le bassinets ait eu le temps de se reconstituer complètement.

Les auteurs estiment que du moment qu'aujourd'hui nous pouvons, grâce à la médication sulfamidée, mieux maîtriser l'infection des voies urinaires, il convient de recourir à la chirurgie conservatrice dans tous les cas d'hydronéphrose où la destruction du parenchyme rénal n'est pas si avancée que la question de sauver l'organe ne se pose pas.

En cas d'obstacle mécanique il faut s'adresser à une forme ou une autre d'opération plastique ou d'anastomose; si aucun obstacle de ce genre à l'écoulement n'est démontrable, c'est la résection du bassinets qui représente l'intervention adéquate.

Dans les interventions où l'on ouvre le bassinets il faut, si possible, établir une pyélostomie, attendu qu'ainsi on crée de meilleures conditions de guérison et diminue le risque de fistule urinaire. Dans deux cas le passage normal de l'urine vers le bas, par l'urètre, se fit attendre environ deux mois, et pendant ce temps elle s'écoula par le drain de la pyélostomie. Les deux fois le résultat final fut bon, avec bonne vidange urinaire et rétrocession de l'hydronéphrose, ce qui doit certainement être mis sur le compte de l'établissement de la pyélostomie.

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